Dept of Civil Engineering
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Nova Scotia Technical College

Calendar

Halifax, N. S.

1910/11

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NOVA SCOTIA TECHNICAL COLLEGE.

CALENDAR.

1910.

September 3, Saturday, Registration for Civil Engineering Summer Camp.

September 5-24, Civil Engineering Summer Camp.

September 26, Monday, Registration for College Classes.

September 27, Tuesday, Lectures begin.

October 31, Thursday to Monday, Thanksgiving vacation.

December 24, Saturday, Christmas vacation.

1911.

January 3, Tuesday, class work resumed.

January 4, Wednesday, Short Course for Land Surveyors begins.

January 23, Monday, Mid-year Examinations begin.

February 1, Wednesday, Second Semester begins.

February 7, Tuesday, Short Course for Highway Construction begins.

February 26, Saturday, { Short Course for Land Surveyors Closes. / Short Course in Highway Construction Closes.

March 24-27, Friday to Monday, Easter Recess.

May 15, Monday, Final Examinations begin.

May 23, Tuesday, Commencement.

May 24, Wednesday, Summer vacation begins; Summer Mining School begins.

June 21, Summer Mining School ends.

PROVINCE OF NOVA SCOTIA.

COUNCIL OF PUBLIC INSTRUCTION.

Hon. G. H. Murray, M. P. P., Premier and Provincial Secretary.
Hon. A. K. Maclean, M. P. P., Attorney General.
Hon. C. P. Chisholm ,M. P. P., Comm'r of Public Works & Mines
Hon. David McPherson, M. P. P.
Hon. H. S. LeBlanc, M. P. P.
Hon. B. F. Pearson, M. P. P.
Hon. James MacDonald, M. P. P.
Hon. Jason M. Mack, M. L. C.
Hon. O. T. Daniels, M. P. P.
A. H. MacKay, LL. D., Superintendent of Education, Secretary.

NOVA SCOTIA TECHNICAL COLLEGE.

BOARD OF GOVERNORS.

Prof. F. R. Haley, M. A., Acadia University.
Prof. E. McKay, Ph. D., Dalhousie University.
Prof. J. B. McCarthy, University of King's College.
Rev. W. W. Andrews, D. D., University of Mount Allison College.
Rev. H. P. McPherson, D. D., University of St. Francis Xavier College.
Prin. F. H. Sexton, Nova Scotia Technical College.
Prof. T. S. Hewerdine, Nova Scotia Technical College.
Prof. R. R. Keely, Nova Scotia Technical College.

NOVA SCOTIA TECHNICAL COLLEGE.

INSTRUCTING STAFF.

F. H. Sexton, S.B., Principal and Prof. of Mining and Metallurgy.
R. R. Keely, M. E., E. E., M. M. E., Prof. of Electrical and Mechanical Engineering.
T. S. Hewerdine, A. B., S. B., Prof. of Civil Engineering.
E. A. Holbrook, S. B., Asst. Prof. of Mining and Metallurgy.
G. F. Murphy, B. E., Instructor of Mining and Metallurgy.
C. A. Hodge, S. B., Instructor in Electrical and Mechanical Engineering.
Francis M. Dawson, Assistant in Civil Engineering.
H. Piers, Librarian and Curator of the Museum.
M. J. McCurdy, Secretary.
W. J. Butler, Jr., Engineer.
M. E. Dickson, Stenographer.

GENERAL STATEMENT.

FOUNDATION AND PURPOSE.

The Nova Scotia Technical College was established by the passing of "An Act Relating to Technical Education" on the 25th day of April, 1907, by the Governor, Council and Assembly of Nova Scotia.

The aims and scope of this institution are outlined in the Public Statutes of Nova Scotia, 1907, Chapter 1, Sections 5–11.

"5. There shall be established at Halifax an institution for the purpose of affording facilities for scientific research and instruction and professional training in civil, mining, mechanical chemical, metallurgical and electrical engineering or any other departments which may from time to time be added.

"6. The institution shall be called the Nova Scotia Technical College.

"7. The Governor-in-Council is hereby authorized to borrow a sum not exceeding $100,000 and to expend the same in securing a site, erecting a building and providing adequate apparatus, plant, books, materials and appliances for the purposes of said institution.

"8. The Council of Public Instruction may from time to time make such rules and regulations as it deems expedient for the efficient conduct of the said institution, and may amend or repeal the same.

"9. The Director of Technical Education shall be the Principal of the said institution.

"10. The Council of Public instruction shall, upon the recommendation of the principal, appoint such professors and instructors as the Council considers requisite for the purposes for which the institution is established.

"11. (1) The members of the teaching staff of the institution, having the rank of professors, and such representative of any university of the province or elsewhere as the Council may select shall constitute a body corporate, under the name of the Nova Scotia Technical College.

"(2) The said corporation shall have power to grant such degrees as it may determine, to prescribe the several qualifications therefor, the course of study to be pursued in the several departments, and in respect to all matters of discipline and all matters connected with the educational work of the institution shall have the conduct and control thereof.

(3) In the event of any part or parts of the course of study prescribed for the first and second years being included in the educational work done in the universities recognized by the Council in this province or elsewhere, the Council of Public Instruction shall exclude such parts from the course of study of the said institution."

At the session of the Provincial Legislature in 1908-9, an additional $100,000. was voted for the construction and equipment of engineering laboratories.

At the session of 1909-10, the Legislature appropriated a further sum of $50,000 for a mining and metallurgical laboratory.

Engineering Building.

The main builing of the Technical College which contains the lecture rooms, science laboratories, museum, library, gymnasium and assembly hall has been completed one year. It is an imposing building of pressed red brick and freestone, erected on the military property adjoining the Court House on Spring Garden Road, in Halifax. This main structure is 146 feet long, 48 feet wide, and has two wings 41 by 52 feet each.

In the basement, room is provided for a work shop, fan room, store room, assaying laboratory, balance room, metallography laboratory, locker room, cement laboratory and gymnasium.

The first floor contains the administration offices, museum, curator's office, geological laboratory, lecture rooms, electrical measurements laboratory, electrical research laboratory, dark room and heat laboratory.

On the second floor are the staff offices, library, chemical laboratory, chemical research laboratory, two lecture rooms drafting room and large assembly hall. The building has a steel frame, reinforced concrete floors and is of slow burning construction throughout.

Engineering Laboratories.

The main building for the engineering laboratories was erected in 1909. This building, 40 x 160 ft., contains the central power plant, mechanical engineering laboratory, machine shop, and materials testing laboratory.

Plans are being prepared for the erection of a mining and metallurgical laboratory which shall contain crushing and concentrating machinery, coal washing apparatus, roasting furnaces, a copper-lead blast furnace, small Bessemer converter, etc. The laboratory will be thoroughly equipped with up-to-date apparatus for teaching purposes and will serve also to carry out research work on the mineral resources of the province.

College Government.

The governing functions of the Nova Scotia Technical College are vested in a Board of Governors and the Council of Public Instruction. The Board of Governors consists of one member nominated by each of the five recognized and affiliated colleges and universities in the Maritime Provinces, together with the professors of the teaching staff of the Technical College.

This Board makes all regulations in regard to admission requirements, general curriculum, and other matters which concern the general standard and welfare of the College. The Board of Governors is under the supervision and control of the Council of Public Instruction and all regulations made by the former body must receive the ratification of the latter.

Affiliation.

The Nova Scotia Technical College is affiliated with the following universities,—Acadia, Dalhousie, King's, Mt. Allison, and St. Francis Xavier. By the terms of the affiliation, the separate universities offer a uniform course in engineering covering the first two years and the Technical College offers professional courses in several departments of engineering covering the last two years' course. Students from the separate universities are admitted to the Technical College on certificate without examination under certain conditions enumerated later. The matriculation requirements for entrance into the uniform engineering course of the separate colleges are also uniform and are to be found in the succeeding paragraph.

Admission to the First Two Years Engineering Course in the Affiliated Universities.

Applicants for admission must have attained the age of 16 years. Persons seeking admission must give satisfactory evidence of proficiency by examination or certificate in the following subjects.

Entrance requirements for engineering into all recognized colleges in Nova Scotia and Mount Allison in New Brunswick.

1. *Arithmetic and Algebra.*

   Arithmetic.

   Algebra as in Hall and Knight's Elementary Algebra excepting Chap. 41.

2. *Geometry and Trigonometry* :
   Geometry : Euclid, Books I to VI, inclusive.
   Trigonometry : As in Murray's Plane Trigonometry. Chaps. I to VIII, or equivalent ; or Practical Mathematics as in Grade XI.
3. *English* :
   As in Grade XI or equivalent.
4. *French or German* :
   As in Grade XI or equivalent.
5. *History* :
   As in Grade XI or English and Canadian History.
6. One of the following :
   (a) *Latin*, as in Grade XI or equivalent.
   (b) *Greek*, as in Grade XI or equivalent.
   (c) Additional work equivalent to that required for Grade XII in the language chosen as *Subject 4*.
   (d) *Mechanical Drawing* : Projection of points, lines, plane figures, and simple solids : dimensioned sketches of simple machine parts ; lettering and dimensioning of drawings neatly and accurately done.

NOTE.—In all cases where mechanical drawing is offered, as in No. 6 (d), all the plates must be submitted together with certificates stating where the drawing was done.

REGULATIONS FOR CONDITIONED STUDENTS.

The following temporary regulation has been adopted by the Governing Board for those applicants who do not attain the required proficiency in every matriculation subject.

No student who has been conditioned in more than one subject of matriculation shall be admitted to the full work of the

first year of the engineering course, and all matriculation conditions must be removed before a student enters upon the second year of the course.

This regulation *does not mean* that a person who is conditioned in more than one subject cannot go to a college and begin to study for the engineering course. It *means* that such a person will not be considered a *full first year student* and will probably have to take two years at that College in preparing to enter the second year of the engineering course. It *does mean* also that a student must not have any matriculation conditions in entering the second year of the course.

Advance of Requirements for Admission to the First Two Years' Engineering Course.

The Advisory Board of Education and the Council of Public Instruction at the present time are considering important modifications of the High School Course in Grade XII and the desirability of requiring this grade for entrance into the first two years engineering course in the affiliated Universities. Due notice will be given of an advance in the requirements at least one year before they go into effect. It is highly probable, however, that the new Grade XII course will be required for matriculation in the autumn of 1911.

Admission to the Technical College.

Applicants must have attained the age of eighteen years.

The students who enter the Technical College will be classified as regular or special. Regular students will be those who are candidates for degrees, and special students are those who voluntarily, or by reason of not having passed all requirements, are taking special courses.

Admission to the Technical College will be on certificate from the properly authorized officer of the University at which the student has pursued his first two years engineering course. This certificate must state the subjects taken, the marks made

in each subject, and the pass mark required at that University in engineering courses. Certificate blanks will be furnished on application to the Principal of the Technical College.

Regular students will be admitted temporarily to the Technical College who have secured the required proficiency in ALL THE COURSES of the first two years Engineering Course as hereafter outlined.

Special Students will not be permitted to take more than three subjects simultaneously.

Note:—The following temporary exception has been adopted:

In 1909, regular students will be permitted to enter the Technical College who are CONDITIONED IN ONE SUBJECT ONLY of the first two year's course, provided that that subject is not one of the following:

Mathematics, Physics, Chemistry, Surveying, or Drawing The right, however, is reserved to exclude as a regular student anyone who has failed in any other subject of the preliminary course than those specified above.

ADMISSION TO ADVANCED STANDING IN THE TECHNICAL COLLEGE

Any person may be admitted to advanced standing in the Technical College by passing such examinations as are deemed necessary by the college faculty or by submitting such certificates of previous records of study or experience as shall satisfy the faculty. All applications for special examinations for advanced standing must be made the principal of the college before September 1st, 1910.

ADMISSION TO SPECIAL CLASSES IN THE TECHNICAL COLLEGE.

Any person on the payment of the required fee and the production of evidence to the faculty of sufficient knowledge and training to benefit by the instruction in any separate class or classes given in the Technical College, may enter and pursue such class or classes as a special student.

Degrees.

To whomsoever shall satisfactorily acquire the requisite proficiency in all the regular courses of either Civil, Mining, Mechanical or Electrical Engineering as prescribed in this calendar shall be given by the Technical College a degree of Bachelor of Science in that department in which he has pursued his studies.

Certificates.

Anyone attending one or more classes in the Technical College and attaining the requisite standard of proficiency in said class or classes shall, on application, receive a certificate attesting to the exact work done.

Tuition Fees, Deposits, Etc.

The tuition for instruction in any regular department of engineering shall be seventy-five dollars ($75) per year, forty dollars of which shall be paid within one month of the opening in September and the remainder during the first month of the second term which begins usually in February.

To those who are attending special classes the fees are as follows:—

For any single course for one-half year, seven and one-half dollars ($7.50).

For any single course for one whole year, twelve dollars ($12.00).

For two or more half or whole year's courses, the fees shall be determined by the Faculty.

Short course for Land Surveyors, fifteen dollars ($15.00)

Short course in Highway Construction, free.

Small deposits shall be required of all students taking laboratory classes on entrance to the same to cover breakage. An itemised account of supplies used by students will be rendered at the end of the year for settlement.

Scholarships.

There is one free scholarship of a value of seventy-five dollars ($75.00) for each of the eighteen counties of Nova Scotia except the counties of Halifax and Cape Breton, for which there are two free scholarships each. These scholarships are to be awarded on the basis of need and merit after the results of the mid-year examinations. The applicants for scholarships must have been bona fide residents for three years in the county for the scholarships for which they are seeking. If there is no applicant in any one year for a certain scholarship, a student resident in any other county for three years previous may by permission of the Faculty apply for the vacant scholarship and may be awarded the same by the Faculty.

First Two Years' Uniform Engineering Course in the Affiliated Universities.

I. Mathematics, (*First and Second years*):—
   1. *Algebra*: Higher Algebra including graphs 72 hours
   2. *Trigonometry*: As in Murray's Plane Trigonometry ..... 18 hours.
   3. *Solid Geometry* ..... 24 hours.
   4. *Analytical Geometry* ..... 60 hours.
   5. *Calculus*: Differential and Integral ..... 90 hours.

II. Chemistry, (*First year*):—
   1. *General Chemistry*: Lectures ..... 72 hours.
   2. *General Chemistry*: Laboratory ..... 90 hours.

III. English ..... 72 hours.

IV. French or German: (One third of time to be devoted to Technical Literature) 72 hours.

V. Drawing: *Mechanical* and *Freehand* ....192 hours.

VI. Workshop .....144 hours.

Note:—Workshop for Mechanical and Electrical Engineers will consist of woodwork and pattern-making. Work-shop for Civil and Mining Engineers will consist of joinery, pattern-making, iron turning and forge work.

(Second Year.)

II. PHYSICS, (*including Mechanics, Electricity, Light and Sound*):

1. Lectures and Recitations..... 96 hours.
2. Laboratory ..... 72 hours.

III. CHEMISTRY (*Qualitative Analysis*):—

1. Lectures..... 24 hours.
2. Laboratory ..... 96 hours.

IV. SURVEYING:—

1. Lectures ..... 24 hours.
2. Field and Laboratory work..... 48 hours.

V. ENGLISH, (Literature and Composition)..... 48 hours.

VI. Either A, B or C according to the course.

A. [FOR CIVIL ENGINEERING].

1. *Descriptive Geometry:* Lectures, Recitation and Drawing..... 72 hours.
2. *General Geology*: Lectures..... 48 hours.
   Laboratory ..... 48 hours.
   Field work (minimum during the open season) ..... 24 hours.
3. Mapping, Topographical Drawing and Field work ..... 48 hours.

B. [FOR MINING ENGINEERING]

1. *Geology:* General Geology as in A.
2. *Mineralogy*: Recitation and Laboratory. 72 hours.
3. *Surveying*: As in A.

C. [FOR MECHANICAL AND ELECTRICAL ENGINEERING].

1. *Descriptive Geometry*: As in A.
2. *Machine Drawing and Design*: Drafting 72 hours.
3. *Workshop*..... 96 hours.

Engineering Camp.

A united engineering camp for students between the second and third and the third and fourth years, will be held in the vicinity of Cape Blomidon, Kings County, September 5th to 25th, 1909. There will be required a deposit of eighteen dollars ($18) for this class.

Short Courses.

The Technical College is offering two special short courses this year, viz: (1) Short Course in Land Surveying. (2) Short course in Highway Construction.

A detailed description of these courses will be found on page —

The course for land surveyors is intended to qualify men to hold positions as land surveyors under the new regulations passed by the Legislature in 1909-1910. Anyone who successfully passes the course is given a certificate as a duly qualified surveyor.

The course in highway construction is designed for those who are engaged in the construction of rural highways. This is a practical course. It is the aim to leave theory in the background as much as possible and to consider for the most part the practical side of road building which concerns every farmer, town officer, and especially every road superintendent and inspector.

Next year it is planned to offer more short courses for stationary and marine engineers, power plant superintendents, colliery officials, etc., if the short course idea meets with approval and success.

Equipment.

A great deal of time and thought has been spent on the equipment for the various laboratories to select a good thorough

up-to-date assembly of apparatus for teaching purposes. The apparatus as far as it has been purchased already is given below.

Civil Engineering.

Surveying Instruments.—1 Queen transit, 2 Gurley transits, 1 Buff and Buff transit, 1 Keuffel and Esser mining transit, 1 Ainsworth transit, 1 Buff and Buff triangulation theodolite, 1 Buff and Buff wye level, 1 Gurley level, 1 Buff and Buff Dumpy level, 1 Gurley level, 1 Stanley level, 1 Keuffel and Esser level.

Testing Machines.—One hundred thousand pounds capacity testing machine, extensometer for tension and compression, improved deflection instrument, improved dial deformeter, Gilmour needle, Briquette moulds, LeChatelier specific gravity apparatus, Olsen's compressed micrometer, encased abrasion cylinder, 2,000 lb. traction dynamometer, 50,000 lb. hydraulic compression testing machine, transverse tester of 10,000 lbs. capacity, 60,000 inch-pound torsion testing machine.

Electrical Engineering.

1 Canada General Electric 50 K. W., D. C., 3 wire 220 V. generator; 1-11 x 12 Robb automatic steam engine; 1 Matheson return tubular boiler for 150 lbs.; 1 Matheson return tubular boiler for 125 lbs.; 1 Westinghouse 60 cell storage battery; 1 Fairbanks 5 H. P. gasoline engine; 1 Fairbanks 4 H. P. special electric gasoline engine; 1 Crosby 6 inch steam test gage; 1 pr. Crosby 2 inch steam engine indicators; 1 Crosby 2 inch standard outside spring steam indicator; 1 Elliott Bros. speed indicator, 2 Esterline dynamometers; 1 Crossley gas engine; 1 McDougall duplex steam pump, 10x6x10; 2 Schuchardt & Schutte initiative revolution counters; 1 Schuchardt & Schutte No. 4 tachometer; 1 Schaeffer 10″ test gage; 1 Schaeffer 6″ test gage; 1 Schaeffer 5″ test gage; 1 Schaeffer 10″ 330 lbs.

test gage; 1 Schaeffer siphon pressure gage; 1 Schaeffer differential draft gage; 1 Schaeffer 7″ pyrometer; 1 Schaeffer gas engine indicator; 1 Washburn twist drill grinder, 1 Washburn variable speed drill; 1 Bertram 28″ drill; 1 Oster hand pipe-threading machine; 1 Pratt & Whitney 14″ machinists' lathe; 1 Gen. Elec. 5 H. P., 220 V., A. C. induction motor; 2 Gen. Elec. 5 H. P., 220 V. A. C., electric motor; 4 Gen. Elec. shunt wound electric motors; 2 Gen. Elec. 10 H. P., 250 V., D. C. electric motors; 1 2½ K. W., D. C. electric generator; 1 ¼-H. P. single phase electric motor; 1 ½ H. P. single phase electric motor; 2 5-H. P. induction motors; 2 5-H. P. compound wound motors; 1 Lincoln variable speed motor; 4 ½-H. P. shunt wound D. C. electric motors; 1 United Wireless, rotary converter; 1 Westinghouse 7½ K. W. rotary converter; 1 Pocket battery voltmeter, 0-3 volts; 1 Bristol recording voltmeter; 1 portable Victor combination meter; 16 Westinghouse carbon break circuit breakers; 2 Westinghouse type "R" portable ammeters; 1 Westinghouse type "C" 10 amp. integrating wattmeter; 3 Pittsburgh 5-H. P. high efficiency electric transformers; 1 Elliott Bros Ewing's hysteresis meter; 1 Elliott Bros. Harrison universal photometer; 1 Elliott Bros. leakage indicator; 2 Esterline 446 volt transformers; 1 Leeds & Northrup Galvanometer; 2 Leeds & Northrup condensers; 1 Leeds & Northrup galvanometer, type "P"; 1 Leeds & Northrup galvanometer, type "H"; 1 Leeds and Northrup condenser; 1 Leees & Northrup potentiometer; 1 Leeds and Northrup stationary photometer; 1 Leeds & Northrup electric dynamometer; 1 Leeds & Northrup electric temperature indicator; 1 Leeds & Northrup Kelvin galvanometer; 1 United Wireless step-up transformer; 1 Weston multimeter testing set; 2 Weston D. C. Voltmeters; 1 Weston milliammeter; 4 Weston voltmeters; 2 portable wattmeters; 2 D. C. ammeters; 1 Weston D. C. Voltmeter; 4 Weston switchboard ammeters; 4 Weston

switchboard voltmeters; 1 Weston lab. std. milli-voltmeter; 1 Weston electric tachometer; 1 Paul reversible meter bridge; 1 Paul meter Carey-Foster bridge; 1 set Biddle variable resistances; 1 Elliott Bros. electric testing set; 1 Elliot Bros. rail bond test set; 1 Griffin electric test set; 1 Sun ray electric arc lamp; 2 Pringle electric arc lamps; 2 Canadian Westinghouse arc lamps; 1 Excello electric arc lamp; 1 German-American electric arc lamp; 2 Stillwell-Vandemark electric arc lamps, with accessories; 2 Gen. Elec. flaming arc lamps; 1 Engler viskometer; 1 Ellison steam calorimeter; 1 Boys calorimeter; 1 Carpenter improved calorimeter; 1 Hayes gas analysis calorimeter; 1 automatic adding machine; 1 mercury arc electric blue printing machine; 1 Can. Foundry Cochran 150-H. P. heater; 1 Can. Fairbanks 10-H. P. steam engine; Machado and Roller frequency meter; 1 Can. Gen. mercury arc rectifier.

Mining Engineering.

In mining engineering the only laboratories equipped so far are the ones for quantitative chemical analysis and assaying. The chemical laboratory has a full stock of chemicals, chemical glassware, porcelain etc. There is a still for distilled water, blast apparatus, steam bath, hot plates, drying closet, etc., and also a number of analytical and fine assay balances

For assaying there are three pot furnaces, a single and a double soft-coal muffle furnace, a coke muffle, a Case gasoline muffle, two gas muffles with high pressure blower, Braun pulverizer, bucking board, etc.

DRAUGHTING ROOM.

DEPARTMENT OF CIVIL ENGINEERING.

The courses offered in this department are for two years of purely technical work. This presupposes at least two years of strong college or University training, which must include certain scientific or technical subjects. Further information concerning the entrance requirements is fully stated elsewhere in this calendar. Although realizing the desirability of including certain other courses for their cultural value, it is deemed wisest to adhere to work of a strictly engineering character.

The new buildings and laboratories are equipped with the latest and most carefully selected apparatus, and also a full technical library affords ample facilities for tests, research and original investigations.

The student is encouraged to read the engineering magazines of America and Europe and to familiarize himself with the reports of technical societies, such literature filling a prominent place in the methods employed.

It is proposed to maintain a high standard of efficiency, equivalent to that of older technical colleges and universities. The methods of instruction involve lectures, recitations, assigned readings, laboratory and field work, designing, visits to existing structures, together with written reports. It is intended to give the student information and practice which will be of direct value in his future professional work, but the highest aim is to encourage independent thinking and investigation, that he may more fully realize his own powers, and be better able to meet the new problems and conditions that may arise in his engineering experience.

101. MECHANICS OF ENGINEERING, I.

THIRD YEAR, FIRST SEMESTER, FIFTEEN WEEKS, FIVE HOURS PER WEEK.

Prerequisite: Third year entrance requirements.

This course deals with the fundamental principles in statics, dynamics and mechanics of materials, and involves the solution of numerous problems, both in and out of class. Both graphic

and analytic methods are employed. The fundamental equations employed in mechanics are deduced.

Statics: Force, its measurement and systems. Force systems, their composition and resolution. Center of gravity and centroid, gravitation, attraction and stress, principles of equilibrium and their application in machinery, flexible cords and framed structures.

Kinematics: Rectilinear, curvilinear and harmonic motion, velocity and acceleration, translation and rotation, moment of inertia, radius of gyration. Friction and its laws. Work and energy and their principles and applications. Impulse, momentum and impact. Calculus is freely used in this course. Special stress is laid on these principles most useful to engineers.

TEXT:

Maurer:—"Technical Mechanics."
Wright:—"Elements of Mechanics."

102. MECHANICS OF ENGINEERING II.

THIRD YEAR, FIRST NINE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: 101.

A continuation of the study of the mechanics of materials begun in course 101, also a study of engineering materials, with assigned readings and reports on the manufacture and properties of steel, wrought iron, cast iron, and the properties of the various woods used in construction, and also brick and stone. The course also comprises the study of stresses and strains in bodies subject to tension, compression and shearing; elastic properties of materials of construction, resilience, fatigue. The theory of strength, curvature, slope and deflection of simple, cantilever and continuous beams. The theory of columns or struts, Euler's, Rankine's, the straigtht line, and other formulas; investigation of the effect of eccentric loading. Torsion, solid and hollow shafts, shaft couplings, cranks, combined stresses, compound columns and beams, reinforced concrete columns and beams, flitched beams. Theory of internal friction, thick pipes,

compound cylinders, hoop shrinkage, cylindrical rollers, spherical rollers, centrifugal tension and flexure.

Investigation and design of riveted joints.

Bending moment and shear diagrams. Simple problems in moving loads.

Numerous problems are solved to familiarize the student with the methods of investigation of stresses in machinery and structures. Laboratory work accompanies this course. (See 103)

TEXT:

Merriman:—"Mechanics of Materials."

Church:—"Mechanics of Engineering."

103. MATERIALS TESTING.

THIRD YEAR, SECOND SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR LABORATORY PERIOD PER WEEK. CONCURRENT WITH 102.

This course consists of a series of tests of the strength and elasticity of the leading materials employed in engineering. Tensile, compressive and shearing tests of cast iron, wrought iron, steel and wood. Determination of modulus of elasticity, elastic limit, yield point, and ultimate strength. Torsion tests. Tests of riveting. Compression tests of brick, concrete and building stone. Tests of paving materials. Bending tests; steel and wood beam tests. Tests of columns of steel and wood.

105. GRAPHIC STATICS.

THIRD YEAR, LAST SIX WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: No. 101.

A study of the general principles of composition and resolution of force and the use of force and funicular polygons in the determination of reactions, centers of gravity, moments of inertia, and bending moments in beams and stresses in frame structures. All modern types of roof and bridge structures are discussed; particular attention being given to those most commonly met with and to the best methods of current practice.

Lectures on influence diagrams. Stresses in portals, two and three hinged arches, combined and eccentric stresses. Stresses in pins. A brief study of mill building construction and design. The student has practice in the graphic and algebraic solution of numerous problems.

TEXT:

Ketchum:—"Steel Mill Buildings."
Malcolm:—"Graphic Statics."

111. THEORETICAL HYDRAULICS.

THIRD YEAR, FIRST NINE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: No. 101.

A consideration of the theory of the pressure and flow of water and its measurement.

Discharge through orifices and nozzles; discharge over notches and weirs; the flow through pipes, conduits, canals and rivers; losses through frictions and other causes; hydraulic coefficients.

Impact and reaction of jets; efficiency; and applications of the principles.

This course is accompanied by laboratory work. (See 112)

TEXT:

Merriman:—"Treatise on Hydraulics."
Unwin:—"Treatise on Hydraulics."

112. HYDRAULIC TESTING.

THIRD YEAR, SECOND SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR PERIOD PER WEEK. CONCURRENT WITH 111.

Experiments for determining the discharge of orifices, nozzles and weirs under varying conditions, and a determination of the coefficients involved. Determination of losses in pipes due to friction and other causes. Measurements with the Venturi meter. Measurement of flow in channels and gauging

of streams, with tubes, floats and current meters. Efficiency tests on the ram, turbine, Pelton wheel, etc.

Students make written reports involving computations, plotted curves, etc., based upon the data collected.

120. DESIGNING AND ADVANCED SURVEYING.

THIRD YEAR, FIRST SEMESTER, FIFTEEN WEEKS, THREE THREE-HOUR PERIODS PER WEEK.

Prerequisite: Third Year Entrance Requirements.

Lectures on Geodesy: Methods of determining the earth's form; and of conducting Geodetic surveys.

Astronomical observations of such a nature as can be made in the field with ordinary engineering instruments, for the determination of latitude, longitude, azimuth, and time.

An Electric Tramway survey, with maps, designs, and estimate of cost. Designs of special railway work and simple railway structures. A completion of the office work of the previous summer's camp; including a neat map showing the preliminary and located lines, topography, etc.

121. RAILWAY LOCATION,

THIRD YEAR, FIRST SIX WEEKS OF FIRST SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: Third year entrance requirements.

A study of railway curves, frogs, switches, crossings, cross-overs, easements or transition curves, vertical curves, and field methods of location; accompanied by the solution of many appropriate problems. The computation and staking out of earth-work. Construction and use of the mass diagram. Organization of field parties and duties of the members, in the various operations involved in reconnaissance, preliminary and location surveys.

This is accompanied by the field work of course 120; and followed by a complete survey of a railway line, while in camp the following summer. (See Course 123).

TEXT AND REFERENCES:

Allen :—" Railroad Curves and Earthwork."
Talbot :—" Railroad Transition Spiral."
Wellington :—"Economic Theory of Railway Location."
Raymond :—" Element of Railroad Engineering."

122. RAILWAY CONSTRUCTION AND MAINTENANCE.

THIRD YEAR, FIRST SEMESTER, LAST NINE WEEKS, FIVE HOURS PER WEEK.

Prerequisite : Course 121.

A continuation of the study of railway location, now giving economics the greater prominence. Form and details of road-bed, ballast, joints, fastenings, ties and their preservation, switching, appliances, water and coal stations, fences, railway crossings, rails, highway crossings, cattle guards, signs, signals, blockings, inter-locking and other safety devices, sidings, terminals, stations, trestles, bridge floors and methods of track laying.

Track policing and maintenance, organization, duties, tools, drainage, alignment, fastenings, renewals, clearing, dust prevention, inspection of bridges and other structures and the snow problem. Operation, costs, effect of distance, rise, fall, friction, atmospheric resistance and curvature ; minor and ruling grades, locomotive types and tractive power.

A study of railways, as to costs, earnings and operating expenses.

TEXTS AND REFERENCES :

Camp :—" Notes on Track."
Raymond :—" Elements of Railroad Engineering."
Wellington :—" Economic Theory of Railway Location."
Tratman :—" Railway Track and Track Work."
Foster :—" A Treatise on Wooden Trestle Bridges."
Byers :—" Economics of Railway Operations."
Adams :—"Block System of Signaling on American Railway."

Railway statistics of the Dominion of Canada, Reports of the Interstate Commerce Commission of the United States.

123. RAILWAY FIELD WORK.

Prerequisite: Third Year Entrance Requirements.

Three weeks of field work in camp in September, preceding each of the third and fourth years. The class follows the methods of modern practice; reconnaissance, preliminary and location, surveys, cross-sectioning and staking out of earthwork. The camp is held in a different part of the Province each year; and a problem as nearly practical as possible is selected, but one which involves many difficulties.

It is intended to give each student practice in every position in the party, and with all the different instruments. Each student keeps a full set of notes. The line is plotted and the topography is filled in as the work proceeds. Preliminary profiles and estimates are made by each student before deciding on the final location.

TEXTS AND REFERENCES:

Allen:—"Railroad Curves and Earthwork."

Allen:—"Field and Office Tables."

Talbot:—"Railway Transition Spiral."

124. RAILWAY STRUCTURES.

FOURTH YEAR, FIRST SEMESTER, FIRST 7½ WEEKS, SIX HOURS PER WEEK.

Prerequisite: Nos. 121, 122 and 123.

Practical railway problems in the design of the simpler structures equipment and apparatus; trackwork, drains, cattle guards, interlocking and other safety devices, yards, trestles, etc.

This course emphasises the structural principles studied in the preceding railway courses.

125. TUNNELING.

FOURTH YEAR, SECOND SEMESTER, TENTH, ELEVENTH AND TWELFTH WEEKS, FIVE HOURS PER WEEK.

Prerequisite: Nos. 301, 102, 111, 141, and 122.

This course consists of recitations, and assigned readings on the principles of tunneling, and the methods employed on some recently constructed tunnels.

TEXTS AND REFERENCES:

Stauffer:—"Modern Tunnel Practice."
Prelini:—"Tunneling."
Sims:—"Practical Tunneling."
Halden:—"Tunneling."

131. ROADS AND PAVEMENTS.

THIRD YEAR, LAST SIX WEEKS OF SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: Third year entrance requirements.

Recitations, assigned readings and reports. The economic justification for the improvement of highways. The theory of location of roads and streets and study of the various types of roads and pavements as to durability. desirability, materials, principles, details, costs and methods of construction and maintenance.

For tests of paving materials, (See No. 103.)

TEXTS AND REFERENCES:

Baker:—"Roads and Pavements."
Byrne:—"Highway Construction."
Judson;—"City Roads and Pavements."
Judson:—"Road Preservation and Dust Prevention."

141. MASONRY CONSTRUCTION.

FOURTH YEAR, FIRST SEMESTER, FIFTEEN WEEKS, FIVE HOURS PER WEEK.

Prerequisite: Nos. 102, 105, 111, 120.

Recitation and reports on assigned readings from standard works and current engineering literature, accompanied by laboratory work, (see 142) and followed by designing (see 143)

A study of the materials of masonry construction: lime, cement, building stone, brick and concrete; methods of construction.

The mechanics of masonry structures and reinforced concrete; bearing power of soils; ordinary and difficult foundations; piling, coffer dams, gravity and arched dams, cylinders, caissons, piers, abutments, retaining walls, masonry and reinforced concrete arches, dredging, etc.

TEXTS AND REFERENCES:

Baker:—"Masonry Construction."
Patton:—"Foundations."
Taylor and Thompson:—"Concrete, Plain and Reinforced."
Fowler:—"Ordinary Foundations."
Schuyler:—"Reservoirs for Irrigation and Water Power."
Wegmann:—"The Design and Construction of Dams."
Howe:—"Symmetrical Masonry Arches."

142. MATERIALS TESTING.

FOURTH YEAR, FIRST SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR LABORATORY PERIOD PER WEEK.

This course accompanies masonry construction (see 141).

The work consists principally in test of cements and plain and reinforced concrete. Tension, compression and transverse tests, with varying conditions, materials and combinations. Tests of beams, slabs, columns and arches.

143. MASONRY AND REINFORCED CONCRETE DESIGN.

FOURTH YEAR, FIRST FOUR WEEKS OF SECOND SEMESTER, TWENTY-FOUR HOURS PER WEEK.

Prerequisite: No. 141.

In this course each student works out his own special and original problems, making complete designs, drawings, tracings, and blue-prints of a reinforced concrete arch, a voussoir arch, a high dam, and a retaining wall.

151. WATER SUPPLY.

FOURTH YEAR, FIRST SEMESTER, LAST NINE WEEKS, FIVE HOURS PER WEEK.

Prerequisite: 102, 111, 301.

Recitations and reports on assigned readings from standard works, engineering magazines, and other technical literature. A study of municipal water supply systems, their design and construction. Quality of water, examination, tests, and methods of purification, sedimentation filtration, etc. Source, quantity, rainfall, evaporation, percolation, storage, reservoirs, ground flow. Wells, pumps and pumping machinery.

Stand-pipes, water-towers, conduits, distribution systems. A study of the quantity required per capita and the variations with diverse conditions. Methods and cost of construction, maintenance and operation.

TEXTS AND REFERENCES:

Turneaure and Russell:—"Public Water Supplies."

Folwell;—"Water Supply Engineering."

Hazen;—"Filtration of Public Water Supplies."

Fanning:—"Water Supply Engineering."

Hazelhurst:—"Towers and Tanks for Water-Works."

McPherson:—"Water-Works Distribution."

Hubbard—Kiersted:—"Water-Works Management and Maintenance."

152. WATER SUPPLY DESIGN.

FOURTH YEAR, FIRST SEMESTER, LAST SEVEN AND ONE-HALF WEEKS, TWO DRAFTING ROOM PERIODS OF THREE HOURS EACH PER WEEK.

Concurrent with No. 151.

Design of stand-pipe, or elevated tank; a water supply distribution system.

153. HYDRAULIC ENGINEERING.

FOURTH YEAR, FIRST NINE WEEKS OF SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: No. 111.

Recitations and reports on assigned readings from standard works, engineering magazines, and reports of Technical Societies, on hydraulic developments for purposes of irrigation, power and transportation.

A study of details and construction of irrigation works, canals, levees, river improvements, harbor work, flood protection.

TEXTS AND REFERENCES:

Mead:—"Water Power Engineering."
Wilson:—"Irrigation Engineering."
Bligh:—"The Practical Design of Irrigation Works."
Schuyler:—"Reservoirs for Irrigation, Water Power, Etc."
Thomas—Watt:—"The Improvement of Rivers."
Church:—"Hydraulic Motors."

161. SEWERAGE.

FOURTH YEAR, FIRST NINE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: 102, 111, 151.

This course consists of recitations and reports on assigned readings from standard works, and the best of current engineering literature. A study is made of the various systems and methods for the removal of sewerage. Separate and combined water carriage systems, quantity and character of sewerage; effect of rainfall. A careful consideration of the problems of design, determination of the proper size and form; and the necessary appurtenances. Methods and cost of construction.

TEXTS AND REFERENCES:

Folwell:—"Sewerage."
Ogden:—"Sewer Design."

Ogden:—"Sewer Construction."
Moore:—"Sanitary Engineering."

162. SEWAGE DISPOSAL AND GENERAL SANITATION

FOURTH YEAR, SECOND SEMESTER, LAST SIX WEEKS, FIVE HOURS PER WEEK.

Prerequisite: No. 161.

This course is a continuation of the work begun in course 161, in which a special study is made of the methods of sewage and garbage disposal; the adaptability, design, construction, operation and cost. Dilution, sedimentation, precipitation; liquefaction; irrigation; land filtration; contract beds, and percolating filters. A study of the methods of collection and disposal of ashes, garbage, rubbish, street sweepings and snow. Also assigned readings and reports on these and other sanitary matters.

TEXTS AND REFERENCES:

Raikes:—"Sewage Disposal Works."
Rideal:—"Sewage and the Bacterial Purification of Sewage."
Venable:—"Garbage Crematories."
Venable:—"Methods and Devices for the Bacterial Treatment of Sewage."
Parsons:—"Disposal of Municipal Refuse."
Gerhard:—"Sanitation of Public Buildings."

163. SEWAGE DESIGN.

FOURTH YEAR, SECOND SEMESTER, LAST TWO WEEKS, TWENTY-FOUR HOURS PER WEEK.

Prerequisite: No. 161.

Complete design, plans, and estimate of cost of construction of a sewerage system for a town or small city.

171. ROOFS AND BRIDGES.

FOURTH YEAR, FIRST SIX WEEKS OF THE FIRST SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: Nos. 102, 105.

This course consists of lectures and recitations on the theory and practice in the design of framed structures; also exercises in the algebraic and graphic methods of computing the stresses. Though the greater portion of the time is devoted to the more common structures, as buildings and roofs, plate girders, viaducts, ordinary highway and railway bridges, yet draw, cantilever, suspension and metalic-arch bridges are briefly considered. This work is taken with course 172.

TEXTS AND REFERENCES:

Ketchum :—"Steel Mill Buildings."

Ketchum :—"Design of Highway Bridges."

Merriman & Jacoby :—"Roofs and Bridges."

Johnson, Bryan & Turneaure :—"Modern Framed Structures."

Skinner :—"Types and Details of Bridge Construction."

Burr and Falk :—"The Design and Construction of Metallic Bridges."

172. ROOFS AND BRIDGES.

FOURTH YEAR, FIFTEEN WEEKS, FIRST SEMESTER, NINE HOURS PER WEEK.

Taken with course 171.

This course consists of three drafting periods of three hours each, also visits to bridges where sketches are made of the structure and details, and afterwards drawn to scale. Complete designs, working drawings, tracings and blueprints are made of a railway plate girder and a riveted highway bridge with estimates of costs in each case.

Different data and conditions are assigned to each student and each one is required to make all necessary computations.

173. BRIDGE DESIGN.

FOURTH YEAR, SECOND SEMESTER, FIFTH TO THIRTEENTH WEEK INCLUSIVE, TWENTY-FIVE HOURS PER WEEK.

Prerequisite: 171, 172.

In this course each student working on different data, makes all computations and designs and prepares working drawings and tracings of a pin connected railway truss, together with an estimate of cost.

181. ENGINEERING TOPICS.

Students will make reports on assigned topics at the meetings of the Engineering Society. The reading of the report will be followed by a general discussion open to the students of all departments and classes.

191. CONTRACTS AND SPECIFICATIONS.

FOURTH YEAR, LAST THREE WEEKS OF SECOND SEMESTER, FIVE HOURS PER WEEK.

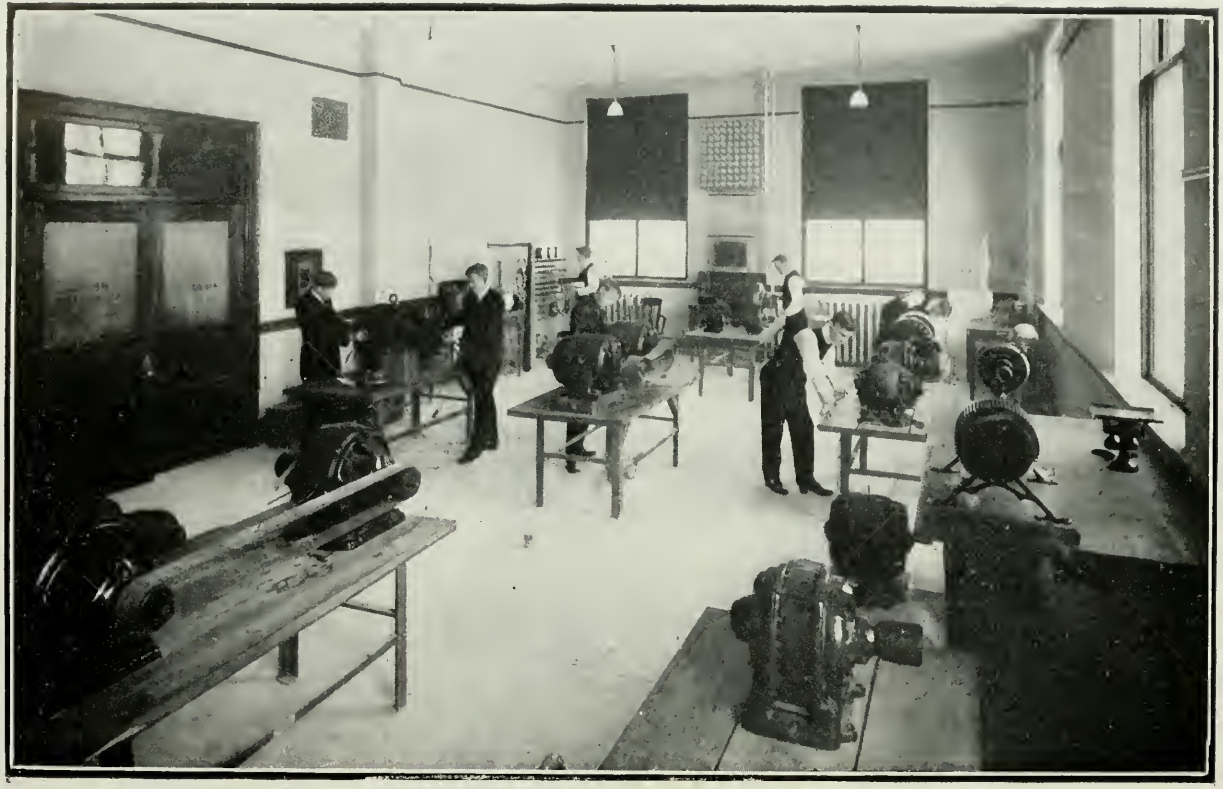
Prerequisite: Preceding work of fourth year.

This course consists of lectures on the law of contracts by prominent attorneys; also a critical study of the form and matter of specifications for engineering constructions.

TEXTS AND REFERENCES;

Johnson:—"Contracts and Specifications."
Waddell:—"Specifications and Contracts."
Tuelser:—"Contracts in Engineering."

201 - ELECTRICAL MACHINERY.
210 - ELECTRICAL ENGINEERING LABORATORY.
301 - THERMODYNAMICS.
310 - MECHANICAL ENGINEERING LABORATORY.
407 - GEOLOGY.
410 - METALLURGY.



ELECTRICAL TESTING LABORATORY.

DEPARTMENT OF ELECTRICAL ENGINEERING.

As announced elsewhere, the first two years of this course are given in the affiliated colleges. The course as herein described covers the third and fourth years. The plan is to give a broad and thorough training in the theory and practice of electricity and mechanical principles, and their application to engineering work.

The laboratories are well supplied with engineering instruments suited to the requirements of the course.

In addition to the electrical laboratories of the main building, a special power laboratory building is provided in which are located the steam plant which heats the College, a 50 Kilowatt Electric Generator, besides equipment of smaller steam and gas engines for experimental work. In this building is also located the materials testing and hydraulic laboratory and a small machine shop. The engineering laboratory building is 160 by 40 feet.

The students taking this course should have a sound theoretical knowledge of mathematics, chemistry, physics and applied mechanics. The theoretical work runs parallel with a course in the laboratories, which extends through the third and fourth years. The laboratory work is carried on with the purpose of developing in the student habits of accurate observations, and of bringing to his consideration, not only methods and tests of fundamental importance, but questions of economy of time and precision of results.

201. ELECTRICAL MACHINERY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

This is a course of three recitations per week. Topics considered are; History of the development of dynamo electric machinery; definitions of dynamo, motor, magnetic field. magneto-motive force, hysteresis, etc; materials used by the electrical engineer: parts of the dynamo and the general consideration of circuits, transformers, motor generators; constant and variable currents and the general effect on an electric circuit.

of a variable current: theory and characteristics of direct current generators and motors, including series, shunt and compound wound machines; the theory of commutation, speed control of motors, and a discussion of the principles of testing electric machinery.

REFERENCE:

Norris:—"Elements of Electrical Engineering."

Sheldon:—"Dynamo Electric Machinery."

S. P. Thompson:—"Dynamo Electric Machinery."

J. A. Ewing:—"Magnetic Induction of Iron and other Metals."

Reid:—"Elemetary Electrical Engineering."

Crocker:—"Electric Lighting," Vols. I & II.

Franklyn and Esty:—"Elements of Electrical Engineering."

202. ALTERNATING CURRENTS AND MACHINERY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, FIVE HOURS A WEEK.

This course is a continuation of 201 and deals more at length with the mechanical theory of alternating current phenomena. It deals with the sine wave in its application to electric circuits, applications in detail to various types of systems, containing impedances in series and parallel, measurements of all power in single phase and polyphase circuits and elementary theory of the transformer.

REFERENCE:

Steinmetz:—"Alternating Current Phenomena."

Weingreen:—"Electric Power Plant Engineering."

Franklyn and Esty:—"Elementary Electrical Engineering Alternating Currents."

Steinmetz:—"Electrical Engineering."

203. ELECTRICAL ENGINEERING ABSTRACTS.

THIRD AND FOURTH YEARS, FIRST AND SECOND SEMESTERS, ONE HOUR PER WEEK.

The students meet once a week for an hour to discuss current magazines, bulletins from manufacturers, proceedings of the Engineering Societies, late inventions and items of general interest to the Engineer.

Reports on various assigned topics will be required.

205. ELECTRICAL DISTRIBUTION.

FOR MECHANICAL AND ELECTRICAL ENGINEERS, FOURTH YEAR, THREE HOURS CREDIT LAST NINE WEEKS FIRST SEMESTER, AND FIRST EIGHT WEEKS SECOND SEMESTER.

This course deals with the transmission of power by means of electrical energy; fundamental problems in transmission line design; conditions effecting choice of apparatus; line voltage, etc. A study will be made of certain leading transmission systems which are at present in operation, with a view of ascertaining the reasons for selecting such apparatus and the effect on the result had another system been chosen.

REFERENCE:

Weingreens:—"Electric Power Plant Engineering."

"Standard Handbook for Electrical Engineers."

Thompson:—"Dynamo Electric Machinery."

Lyndon:—"Development and Electrical Distribution of Water Power."

Hobart:—"Heavy Electrical Engineering."

206. ELECTRIC RAILWAYS.

FOURTH YEAR, ELECTRICAL ENGINEERS, SECOND SEMESTER, LAST SIX WEEKS, FIVE HOURS A WEEKS, TWO HOURS CREDIT.

Study of conditions effecting choice of apparatus; power requirements, cars and car equipments, track construction bonding, testing, and distribution systems.

This course is intended to give the student a thorough knowledge of the principles of electric railway engineering. A study will be made of acceleration, tractive force and power required, power generation, transmission, distribution, electric locomotives and their electrical equipment.

REFERENCE:

Parshall and Hobart:—"Electric Railway Engineering."
Parshall and Hobart:—"Standard Handbook for Electrical Engineers."
Bell:—"Electric Distribution for Electric Railways."
Gozenbock:—"Engineering Preliminaries for an Interurban Electric Railway."

207. ELECTRIC DESIGN PROBLEMS.

FOURTH YEAR, SECOND SEMESTER, LAST EIGHT WEEKS, SIX HOURS PER WEEK.

A course of laboratory and drafting to accompany No. 205. This course takes up the design of electrical machinery and equipment, as included in the theoretical text book and lecture work in connection with the course. Various practical problems will be assigned during the year in connection with the course and the lecture room work. It is intended to give the student a knowledge of the application of the principles gained.

REFERENCE:

Parshall and Hobart:—"Electric Machinery Design."
Norris and Dennison:—"A Course of Problems."

208. ELECTRICAL MACHINERY.

MINING ENGINEERS, FIRST SEMESTER, THREE HOURS PER WEEK.

This is a special course in Electrical Machinery for students not specializing in Electrical Engineering. It is designed to give the student a general knowledge of the design, construction and operation of electric dynamos, motors, transformers, and measuring instruments of various types and makes. In the

accompanying laboratory course, the student is made familiar with the handling, operating and testing of electrical machinery.

REFERENCE:

Rosenberg:—"Electrical Engineering."
Sheldon and Mason:—"Alternating Current Machinery."
Franklin and Esty:—"Elements of Electrical Engineering."

209. ELECTRICAL MEASUREMENTS & PHOTOMETRY.

ELECTRICAL ENGINEERS, FOURTH YEAR, SECOND SEMESTER, THREE HOURS CREDIT, FIRST SEVEN WEEKS, FIVE HOURS LECTURE AND RECITATION AND TWO LABORATORY PERIODS.

This course deals with electric measuring instruments, their construction and sources of error. Precise measurements are made of current, electric-motive force, magnetism, induction and permeability. Practice is given in the calibration of measuring instruments. There is also a study made of illuminants in general and the performance of various types of arc, incandescent and vapor lamps and measurements made of their illuminating power.

REFERENCE:

Wickenden:—"Illumination and Photometry."
Carhart and Patterson:—"Electrical Measurements."
Cravath and Lansingh:—"Practical Illumination."
Stine:—"Photometric Measurements."
Karapetoff:—"Experimental Electrical Engineering."
Steinmetz:—"Radiation, Light and Illumination."

210. ELECTRICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, ONE THREE-HOUR PERIOD A WEEK, TWO HOURS CREDIT.

A series of experiments to accompany course No. 201. Its purpose is to illustrate the fundamental principles and to give the student practice in operating and testing electrical machinery. The first experiments are in the construction and

use of electric measuring instruments followed by a study of methods and practice in testing motors, generators, convertors, motor generators, constant current machines and arc and incandescent lamps.

REFERENCE:

Karapetoff:—"Laboratory Manual."

C. F. Smith:—"Testing of Dynamos and Motors."

Franklin and Esty:—"Dynamo Laboratory Manual."

Sever:—"Electric Engineering Experiments."

Sever and Townsend:—"Factory and Laboratory Tests in Electrical Engineering."

Swensen and Frankenfield:—"Testing of Electro-magnetic Machinery."

211. ELECTRICAL ENGINEERING LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, ONE THREE HOUR PERIOD PER WEEK, TWO HOURS CREDIT.

A continuation of course No. 210, dealing with testing of electrical machinery, precise electrical measurements, standardization and photometry.

Ample equipment is provided for the determination of fundamental quantities,—current potential and resistance, and for the measurement of capacity, inductances and magnetic properties of iron.

Power is supplied from the Technical College Central Station and from a 200 ampere hour storage battery.

Opportunities for special investigations will be afforded to fourth year students.

Studies will be made of alternators, synchronous motors, induction motors, rotary converters and transformers.

Apparatus will be provided for the investigation of wave forms and resonance.

REFERENCE:

See No. 210.

212. STORAGE BATTERY ENGINEERING.

FOURTH YEAR, FIRST SEMESTER, FIRST NINE WEEKS, FIVE HOURS PER WEEK.

This is designed to give the student a knowledge of the principles of storage battery engineering in connection with power generation and distribution.

Questions of efficiency, diseases and their remedies, assembling and installing, testing, regulation and maintenance, will be considered.

REFERENCE:

Lyndon:—"Storage Battery Engineering."

"Standard Handbook for Electrical Engineers."

220. CONTRACTS AND SPECIFICATIONS.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS, SECOND SEMESTER, ONE HOUR CREDIT.

This course is designed to give the student a general knowledge of preparing specifications and the law of contracts. Lectures on the subject by practising solicitors will be arranged during the course.

REFERENCE:

Wait—"Law of Contracts."

Johnson—"Contracts and Specifications."

301. THERMODYNAMICS.

THIRD YEAR, FIRST SEMESTER, FIVE HOURS A WEEK, LECTURES AND RECITATIONS.

This course in heat is considered one of the fundamentals of engineering and great stress is laid on the thorough mastery of its laws.

The elementary laws of heat and its effect are studied; the general laws of thermodynamics; theoretical heat engines,

isothermal and adiabatic expansion; the application of the laws to the steam and other engines; the principles governing the transfer of heat from gases to water.

REFERENCE:

Ewing's—"Steam Engine."

Geberhardt—"Steam Power Plant Engineering."

Benjamin—"Heat and Steam."

French—"The Steam Turbine."

Hutton—"Steam Engines."

Stadola—"Steam Turbine."

Peabody—"Thermodynamics of Steam Engineering."

Ripper—"Steam Engine."

302. STEAM MACHINERY.

THIRD YEAR, SECOND SEMESTER, LAST SIX WEEKS, FIVE HOURS A WEEK, LECTURES AND RECITATIONS.

This is a continuation of Course 301. It deals with fuel and its heat value, coal and ash handling machinery; furnaces, stokers and combustion,—installation and operation. Running parallel with it is the laboratory course in Engine and Boiler testing.

REFERENCE:

Same as No. 301.

303. STEAM POWER PLANTS.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS. FIRST SEMESTER, SIX WEEKS, FIVE HOURS A WEEK AND SECOND SEMESTER, FIFTEEN WEEKS, FIVE HOURS A WEEK.

A general study of choice of types in power station equipment, fuels and combustion, boilers, furnaces and mechanical stokers, superheat, coal and ash handling, chimneys, mechanical draft, steam engineering, steam turbines, condensers, and accessories and gas engines and gas producers, etc.

REFERENCE:

Hobart:—"Heavy Electric Engineering."
Geberhart:—"Steam Power Plant Engineering."
Weingreen:—"Electric Power Plant Engineering."
Fernald:—"Prime Mover and Power Plants."
Hutton:—"Mechanical Engineering of Power Plants."
Jones:—"Gas Engine."
Carpenter and Diedrichs:—"Gas Engine."

310. MECHANICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A course of testing indicators and gauges, steam and gas and gasoline engines; dynamometers and the measurement of power, pyrometers and the measurement of heat; calorimeters, for steam and gas; pumping machinery and hydraulic motors.

REFERENCE:

Carpenter's:—"Experimental Engineering."

311. MECHANICAL ENGINEERING LABORATORY

FOURTH YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A continuation of course No. 310, and deals with the more difficult problems of efficiency tests, power plant and commercial tests. Visits will be made to local plants and in some cases arrangements may be made to conduct tests under the direction of the college officials.

REFERENCE:

Carpenter's:—"Experimental Engineering."
Flather's:—"Dynamometers and the Measurement of Power."

330. MACHINE DESIGN.

THIRD YEAR, FIRST SEMESTER, THREE HOURS PER WEEK.

This course makes practical application of the laws of mechanics, physics and kinematics to actual machine building.

Designs of various machines will be considered and drawings made in the accompanying course of drawing.

REFERENCES:

Smith and Marx:—"Machine Design."
Spooner:—"Machine Design."
Unwin:—"Machine Design."
Dunkerly:—"Mechanism."

331. MACHINE DESIGN AND DRAWING.

THIRD YEAR, FIRST AND SECOND SEMESTER, TWO DRAWING PERIODS PER WEEK.

Lettering of mechanical drawings, preparations of working drawings of simple machines; design of machine parts; tracing and blueprinting.

332. MACHINE DESIGN AND DRAWING.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS.

A course of two lectures and recitations, last six weeks first semester, and first seven second semester, continuing course 330. Design of cams and gear teeth, details of standard machinery, belt and pulley transmission, pipes and pipe joints and engine details.

101. MECHANICS OF ENGINEERING, I.

THIRD YEAR, FIRST SEMESTER, FIFTEEN WEEKS, FIVE HOURS PER WEEK.

Prerequisite, third year entrance requirements.

Recitations in statics, dynamics, and mechanics of materials; with graphic and analytic solutions of problems.

See page .... for detailed description.

102. MECHANICS OF ENGINEERING, II.

THIRD YEAR, FIRST NINE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: 101.

A continuation of the study of the mechanics of materials

begun in Course 101, also a study of engineering materials and the elastic limits, working stresses, and ultimate resistances of cast iron, wrought iron, steel, timber, stone, etc. Laboratory work accompanies this course. (See 103.)

TEXT:

Merriman:—"Mechanics of Materials."

103. MATERIALS TESTING.

THIRD YEAR, SECOND SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR LABORATORY PERIOD PER WEEK.
CONCURRENT WITH NO. 102.

Testing wrought iron, cast iron, steel and wood; in tension in compression, transversely, in sheer: torsion tests, bending tests, tests of riveting, concrete beams, etc.

105. GRAPHIC STATICS.

THIRD YEAR, LAST SIX WEEKS OF THE SECOND SEMESTER FIVE HOURS PER WEEK.

Prerequisite: No. 101.

A study of the general principles of the force and equilibrium polygons; and the application of these principles in determination of stresses in framed structures; of sheer and bending moment in beams.

TEXT:

Malcolm:—"Graphic Statics."

Ketchum:—"Steel Mill Buildings."

111. THEORETICAL HYDRAULICS.

THIRD YEAR, FIRST NINE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: No. 101.

A consideration of the theory of the pressure and flow of water and its measurement. The design and construction and

use of pumps, rams, propellers, turbines and other types of water wheels. This course is accompanied by laboratory work (See 111.)

TEXT.

Unwin:—"Hydraulics."

112. HYDRAULIC TESTING.

THIRD YEAR, SECOND SEMESTER, FIFTEEN WEEKS, ONE THREE HOUR PERIOD PER WEEK.
CONCURRENT WITH 111.

Experiments for determining the discharge of water through pipes, orifices, weirs; also efficiency tests on the ram, turbine, pelton wheel, etc.

410. METALLURGY OF IRON AND STEEL.

FOURTH YEAR, FIRST SEMESTER, TWO HOURS A WEEK.
SHORT COURSE FOR CIVIL, ELECTRICAL AND MECHANICAL ENGINEERS.

This course deals principally with the physical and chemical properties of iron and steel rather than with the metallurgical chemistry or the special machinery used in the various processes of manufacture. A great deal of stress is laid upon the influence of hot and cold working, heat-treatment, the effects of the various elements on the physical properties of steel and the writing of specifications for rails, plates, structural steel, etc.

Materials used in steel making:—Ore fuel and flux.

Manufacture of Pig Iron:—Blast furnace construction and operation, chemical processes involved, chemical and physical properties of cast iron.

Manufacture of Steel:—Different processes, acid and basic Bessemer, modes of operation, elimination of impurities, recarburization, differences between acid and basic processes in operation and product, construction and operation of open-hearth furnace, producers, coke ovens, heating furnaces, acid open-hearth practice, elimination of impurities, recarburization, comparisons of acid and Bessemer and other open-hearth processes.

Special Steels:—Manufacture of crucible steel, chemical history of crucible melting, high carbon steels in the open-hearth furnace, manufacture of steel castings, blowholes, special alloys in the electric furnace.

Wrought Iron:—History, modes of production, elimination of impurities, comparison with soft steel.

Foundry Work:—Different classes of molds, cupela furnaces, methods of casting, malleable castings.

Mechanical Treatment:—Segregation and homogeneity, soaking pits, rolling of steel, percentage decrease in passes, effect of thickness upon the physical properties of rolled shapes, forging, hydraulic forge press.

Heat Treatment: — Annealing, working temperatures, quenching, harding, tempering, influence of hot and cold working, relation of work and temperature, effects of work on structure of rails, structural shapes, etc., effects of heat treatment on various classes of steels.

Effects of various elements in Steel:—Influence of carbon, silicon, manganese, sulphur, phosphorus, nickel, tungsten, vanadium, chromium, etc., on the physical properties of steel.

Structure of Steel:—Steel, a solution of various elements in iron, analogies in physical chemistry, critical points, microstructure of steels, theories regarding the structure of steel.

Specifications:—Chemical and physical specifications for structural steel, rails, boiler plate, rods, etc., methods of testing.

TEXT BOOK:

Stoughton:—"Metallurgy of Iron and Steel."

BOOKS FOR STUDY:

F. W. Harbord:—"Metallurgy of Steel."

H. H. Campbell:—"Manufacture and Properties of Steel"

111. DEPARTMENT OF MECHANICAL ENGINEERING.

This is a four year's course, the third and fourth of which are given in the Technical College, as outlined in the following schedule. It is designed to give the student a thorough knowledge of the basic principles of the design, construction, manufacture and operation of machinery as used in manufacturing industries, power plants and power transmission as well as a general knowledge of executive management of the industries and plants.

Students who take the course should have a thorough training in mathematics, physics and shop work, and should have a natural aptitude in machinery, engines and tools.

All mechanical engineers require a good general knowledge of electricity, and all electrical engineers require training in mechanical principles. Therefore the two courses are similar throughout and identical in the third year. In the fourth year the student is given less of electricity and electrical machinery and goes deeper into the study and design and performance of machinery, steam and gas engines and steam turbines. The mechanical laboratories are designed and equipped so as to give the student the necessary practice in the handling of machines and the testing and operation of engines. The equipment is thoroughly modern and adapted to illustrate the principles of the course as given in the class room.

In addition to the college laboratory practice, visits will be made to the local power plants and manufacturing industries.

301. THERMODYNAMICS.

THIRD YEAR, FIRST SEMESTER, FIVE HOURS A WEEK, LECTURES AND RECITATIONS.

This course in heat is considered one of the fundamentals of engineering and great stress is laid on the thorough mastery of its laws.

The elementary principles of heat and its effect are studied; the general laws of thermodynamics; theoretical heat engines, isothermal and adiabatic expansion; the application of the laws to the steam and other engines; the principles governing the transfer of heat from gases to water.

REFERENCE:

Ewing's :—"Steam Engine."
Geberhardt :—"Steam Power Plant Engineering."
Benjamin :—"Heat and Steam."
French :—"The Steam Turbine."
Hutton :—"Steam Engines."
Stadola :—"Steam Turbine."
Peabody :—"Thermodynamics of Steam Engineering."
Ripper :—"Steam Engine."

302. STEAM MACHINERY.

THIRD YEAR, SECOND SEMESTER, THREE HOURS A WEEK. LECTURES AND RECITATIONS.

This is a continuation of course No. 301. It deals with fuel and combustion, furnaces, boilers and steam production; the steam engine, the indicator and engine economy; condensors and auxilliary machinery. Running parallel with it is the laboratory course in Engine and Boiler testing.

REFERENCE:

Same as No. 301.

303. STEAM POWER PLANTS.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS, FIRST SEMESTER, SIX WEEKS, FIVE HOURS A WEEK AND SECOND SEMESTER, FIFTEEN WEEKS, FIVE HOURS A WEEK.

A general study of choice of types in power station equipment; the economics of efficiency vs. cost; fixed and operating charges; local conditions relative to each case which govern in choice of machinery; the cost of power; the laying out of power plants under assumed working conditions; design, preparation of bill of material, estimating the first cost; the influence of the cost of raw material, fuel, water, labor, and load factor, on the design; preparation of contract and specification.

TEXT:

Geberhart :—" Steam Power Plant Engineering."

REFERENCE:

Fernald :—" Prime Movers and Power Plants."
Hutton :—" Mechanical Engineering of Power Plants."
Jones :—" Gas Engine."
Carpenter and Diedrichs :—" Gas Engine."

304. STEAM TURBINES.

FOURTH YEAR, FIRST SEMESTER, MECHANICAL ENGINEERS, TWO HOURS CREDIT.

A study of the types of turbines and the theory of their performance, the flow of steam and its action on the curved surface of the buckets, efficiency of turbines and their utility in general as compared with other forms of steam engine.

TEXT AND REFERENCE:

Stadola :—" The Steam Turbine."

305. GAS ENGINES.

FOURTH YEAR, FIRST SEMESTER, MECHANICAL ENGINEERS, FIRST NINE WEEKS, THREE HOURS CREDIT.

Gas engine types and points to be considered in making selection, small gas and gasoline engines, stationery and marine larger producer gas engines their design and operation, including methods of starting and igniting and sources of trouble, gas producers, their design, operation and efficiency.

REFERENCE:

Lucke:—"Gas Engine Design."
Carpenter and Diedrichs:—"Gas Engines.
Jones:—"Gas Engine."
Robinson:—"Gas and Oil Engines."

306. MECHANICAL ENGINEERING ABSTRACTS.

FOURTH YEAR, FIRST AND SECOND SEMESTER, MECHANICAL ENGINEERS, ONE HOUR.

This is a course dealing with current engineering problems. Topics will be assigned and reports required based on discussions in current engineering magazines, which will be on file in the library of the college.

307. STEAM BOILERS.

FOURTH YEAR, MECHANICAL ENGINEERS, SECOND SEMESTER LAST SIX WEEKS, TWO HOURS CREDIT.

The design and construction of steam boilers; horizontal return tubular boiler, the shell, tubes, and methods of riveting and staying; water tube boilers,—horizontal and vertical, a study of the relative merits of the various types.

REFERENCE:

Parsons:—"The Steam Boiler."
Peabody and Miller:—"The Steam Boiler."
Geberhardt:—"Steam Power Plant Engineering."
Kent:—"Steam Boiler Economy."

310. MECHANICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A course of testing indicators and gauges, steam and gas and gasoline engines; dynamometers and the measurement of power, pyrometers and the measurement of heat; calorimeters, for steam and gas; pumping machinery and hydraulic motors.

REFERENCE:

Carpenter's:—"Experimental Engineering."

311. MECHANICAL ENGINEERING LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A continuation of course No. 310, and deals with the more difficult problems of efficiency tests, power plant and commercial tests. Visits will be made to local plants and in some cases arrangements may be made to conduct tests under the direction of the college officials.

REFERENCE:

Carpenter's:—"Experimental Engineering."
Flather's:—"Dynamometers and Measurement of Power."

322. HEATING AND VENTILATING.

FOURTH YEAR, FIRST SEMESTER, MECHANICAL ENGINEERS, FIRST NINE WEEKS, FIVE HOURS PER WEEK, THREE HOURS CREDIT.

This course of lectures and recitations is planned to acquaint the student with the fundamental principles of the subject, and the proper application of the principles to practice, in the solution of heating and ventilating problems. The course considers quantity of air required, direct and indirect, steam, hot water and hot air systems; size of ducts, radiators, and total heating surface required; design of heating plants and selection of equipment.

REFERENCE:

Carpenter:—"Heating and Ventilating."
Baldwin:—"Heating and Ventilating."

330. MACHINE DESIGN.

This course makes practical application of the laws of mechanics, physics and kinematics to actual machine building. Designs of various machines will be considered and drawings made in the accompanying course of drawing.

Smith and Marx:—"Machine Design."
Spooner:—"Machine Design."
Unwin:—"Machine Design."
Dunkerly:—"Mechanism."

331. MACHINE DESIGN AND DRAWING.

THIRD YEAR, FIRST AND SECOND SEMESTER, TWO DRAWING PERIODS PER WEEK.

Lettering of mechanical drawings, preparations of working drawings of simple machines; design of machine parts; tracing and blueprinting.

332. MACHINE DESIGN AND DRAWING.

FOURTH YEAR MECHANICAL AND ELECTRICAL ENGINEERS.

A course of two lectures and recitations, last six weeks first semester, continuing course No. 330. Design of cams and gear teeth, details of standard machinery, belt and pulley transmission, pipes and pipe joints and engine details.

TEXT AND REFERENCE:

Benjamin:—"Machine Design."
Spooner:—"Machine Design."
Reid:—"Machine Design."
Unwins:—"Machine Design."
Anthony:—"Essentials of Gearing."

333. MACHINE DESIGN AND DRAWING.

FOURTH YEAR, MECHANICAL ENGINEERS, SECOND SEMESTER.

A continuation of No. 331, dealing with more difficult problems in the design of steam engines, gas engines and machine tools.

334. DESIGN PROBLEMS.

FOURTH YEAR, SECOND SEMESTER.

A course of problems as assigned in design along lines in which the student expects to specialize.

201. ELECTRICAL MACHINERY.

MECHANICAL AND ELECTRICAL ENGINEERS, FIRST AND SECOND SEMESTER.

This is a course of three recitations per week. Topics considered are:—History of the development of Dynamo-Electric Machinery, definitions of dynamo, motor, magnetic field, magneto-motive force, hysteresis, etc. Materials used by the electrical engineer, parts of the dynamo and the general consideration of circuits, transformers, motor generators, constant and variable currents and the general effect on an electric circuit of a variable current; theory and characteristics of direct current generators and motors, including series shunt and compound wound machines; the theory of commutation, speed control of motors, and a discussion of the principles of testing electric machinery.

TEXT BOOK.

Norris:—"Elements of Electrical Engineering."

REFERENCE.

Sheldon:—"Dynamo Electric Machinery."

S. P. Thompson:—"Dynamo-Electric Machinery."

J. A. Ewing:—"Magnetic Induction of Iron and other Metals."

Reid:—"Elementary Electrical Engineering."

Crocker:—"Electric Lighting, Vol. I and II."

Franklin & Esty:—"Elements of Electrical Engineering."

203. ELECTRICAL ENGINEERING ABSTRACTS.

THIRD AND FOURTH YEARS, FIRST AND SECOND SEMESTER.

The students meet once a week for one hour to discuss current magazines, bulletins from manufacturers, proceedings of the Engineering Societies, late inventions and items of general interest to the Engineer.

Reports on various assigned topics will be required.

205. ELECTRIC DISTRIBUTION.

MECHANICAL AND ELECTRICAL ENGINEERS, FOURTH YEAR, FIRST AND SECOND SEMESTER.

This course deals with the transmission of power by means of electrical energy; fundamental problems in transmission line design; conditions affecting choice of apparatus; line voltage, etc. A study will be made of certain leading transmission systems which are at present in operation with a view of ascertaining the reasons for selecting such apparatus and the effect on the result had another system been chosen.

REFERENCE.

Weingreen:—"Electric Power Plant Engineering."

Crocker:—"Electric Lighting."

"Standard Handbook for Electrical Engineers."

Thompson:—"Dynamo Electrical Machinery."

Lyndon:—"Development and Electrical Distribution of Water Power."

Hobart:—"Heavy Electrical Engineering."

210. ELECTRICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER.

A series of experiences to accompany course No. 201. Its purpose is to illustrate the fundamental principles and to give the student practice in operating and testing electrical machinery. The first experiments are in the construction and use of electric measuring instruments followed by a study of methods and practice in testing motors, generators, convertors, motor generators, constant current machines and arc and incandescent lamps.

TEXT BOOK.

Karapetoff—"Laboratory Manual."

REFERENCES:

C. F. Smith :—"Testing of Dynamos and Motors."

Franklyn & Esty :—"Dynamo Laboratory Manual."

Sever :—"Electric Engineering Experiments."

Sever & Townsend :—"Factory and Laboratory Tests in Electrical Machinery."

Swensen & Frankenfield :—"Testing of Electro-magnetic Machinery."

211. ELECTRICAL ENGINEERING LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER.

A continuation of course No. 210, dealing with testing of electrical machinery, precise electrical measurements, standardization and photometry.

TEXT AND REFERENCE.

See No. 210.

220. CONTRACTS AND SPECIFICATIONS.

MECHANICAL AND ELECTRICAL ENGINEERS, SECOND SEMESTER.

This course is designed to give the student a general knowledge of preparing specifications and the law of contracts Lectures on the subject by practicing solicitors will be arranged during the course.

101. MECHANICS OF ENGINEERING, I, See p. 17.
102. THEORETICAL MECHANICS, See p. 18.
103. MATERIALS TESTING, See p. 19.
105. GRAPHIC STATICS, See p. 19.
111. THEORETICAL HYDRAULICS, See p. 20.
112. HYDRAULIC TESTING, See p. 20.
410. METALLURGY OF IRON AND STEEL See p 42.

MECHANICAL ENGINEERING LABORATORY.

DEPARTMENT OF MINING ENGINEERING.

400. QUANTITATIVE ANALYSIS.

THIRD YEAR, FIRST AND SECOND SEMESTERS, LECTURE ONE HOUR A WEEK, LABORATORY NINE HOURS A WEEK BOTH TERMS.

The aim of this course is to acquaint the student with the theory and practice of representative methods of gravimetric and volumetric quantitative analysis. A high standard of accuracy is required in most of the work so that the student may be qualified to make analysis of the refinement demanded in umpire work. Toward the end of the course, the student is familarized with some common commercial methods for analyzing ores, slags, and metallurgical products and is required to make a certain number of determinations within a time to limit.

Reports must be written up to date, and handed in at the end of every week, otherwise full value for the work cannot be obtained.

The lectures cover the chemical theory upon which the separations are based with stochiometrical problems and elementary treatment of the theory of solutions.

The following analyses are included in the course and are supplemented with extra work according to the rapidity with which each individual works:

Water, sulphur, and magnesia in crystallized magnesium sulphate; iron gravimetrically and volumetrically in ferric ammonium alum; silica, sulphur, phosphorus, iron in iron ore; carbon, sulphur, silicon, manganese, in steel or pig iron; silica, iron and alumina, calcium and magnesium in limestone or dolomite; lead, copper, and zinc in brass; zinc, copper, lead, antimony, and arsenic in ores; tin in bearing metal; slag analysis, flue gas analysis; sulphur in coal, proximate analysis of coal, calorific power of coal.

TEXT BOOKS:

Miller—"Quantitative Analysis for Mining Engineers."
Talbot—"Quantitative Analysis."
Blair—"Chemical Analysis of Iron."
Low—"Technical Methods of Ore Analysis."

406. MINERALOGY.

THIRD YEAR, SECOND SEMESTER, FIVE HOURS PER WEEK.

This course includes descriptive and determinative mineralogy.

The time will be largely given to laboratory work in order to train the student to determine minerals accurately and rapidly by their physical and chemical properties, to make him thoroughly acquainted with the appearance, properties, uses and association of the more important mineral species.

The determinative mineralogy begins with drill in the methods of blow-pipe analysis with a view to preparing the student for the practical determination of the more important ore making minerals.

This is followed by determinative mineralogy proper.

Text Books:

Moses and Parsons—"Cyrstallography, Mineralogy, and Blow-pipe Analysis."

Butler—"Hand-book of Minerals."

Books of Reference.

Brush and Penfield—"Manual of Determinative Mineralogy and Blow-pipe Analysis."

Dana—"Textbook of Mineralogy."

407. ECONOMIC GEOLOGY.

FOURTH YEAR, TWO HOURS A WEEK, DURING FIRST AND SECOND SEMESTER.

First Semester: The non-metallic minerals; the distribution and modes of occurrence of coal, petroleum, natural gas, asphalt, building stones, clay, lime and calcareous cements, gypsum, salines, fertilizers, abrasives, minor minerals, water supply, soil, and road materials; their properties, sources and uses will be studied as much in detail as possible in the time available.

Second Semester: Discussion of general features and formation of ore deposits; the cause of formation of cavities in rocks; their relation to ore bodies; discussion of the theories of ore deposition; description of deposits of ores of iron, copper, lead, zinc, silver, gold, and lesser metals, with their occurrence, structure and geographic distribution.

Books.

Kemp—"Ore Deposits of the United States and Canada."
Ries—"Economic Geology of the United States."
Beck—"Nature of Ore Deposits."
Merrill—"Rock Weathering and Soils."
"Reports of the Geological Surveys of the United States and Canada."

405. STRUCTURAL AND APPLIED GEOLOGY.

TWO HOURS A WEEK LECTURES, THIRD YEAR, FIRST SEMESTER. FIELD WORK, ONE WEEK IN THE SUMMER SCHOOL OF MINING.

The lecture course deals with structural geology with respect to its effect on ore deposits. The principles of structural dynamical and chemical geology, practically applied to economic advantage in finding and exploiting ore bodies. Estimating the dip and strike of rocks, study of faults, folds, joints, etc., their relation to ore deposits and effects on previously formed ore bodies; careful study of the functions of fault movement; effects of glacial action; study of the various kinds of placer deposits; study of ore concentration by underground waters; secondary enrichment, metamorphism; process of ore deposition and concentration; arrangement of stratified rocks, their origin and characteristics; study of igneous rocks, classification and physical characters.

Field Work.

The field work is individual. The student will be required to make a careful study of some special portion of a quadrangle assigned to him, and to observe faults, folds, erosion, weathering, glacial phenomena, igneous and sedimentary rocks; cleavage, jointing, etc., making careful notes of all the dips and

strikes. A full and accurate geological map, with cross sections, will be required, also a short report on the work. The map will show the geological distribution and boundaries, the location of all important outcrops and structural features.

BOOKS:

Spurr—"Geology Applied to Mining."

Geikie—"Structural Geology."

415. MINE SURVEYING,

THIRD YEAR, FIRST SEMESTER, LECTURE ONE HOUR PER WEEK FIELD WORK AND MAPPING, THREE HOURS A WEEK.

This course aims to acquaint the student with the special adaptation of surveying instruments and practices that are common in mine surveying.

Syllabus of course of mine surveying instruments and accessories, underground stations, carrying meridian underground, survey of secondary opening, survey record, use of mine maps, plotting mine maps, map filing, bore hole surveys.

TEXT BOOKS:

Trumbull—"Underground Surveying."

BOOKS FOR STUDY.

Brough—"Mine Surveying."

Lupton—"Mine Surveying"

466. SUMMER COURSE IN MINING.

THIRD YEAR, SUMMER VACATION, FOUR TO SIX WEEKS OF OBSERVATION SKETCHING, ETC., AT TYPICAL PLANTS.

This course which lasts from four to six weeks in the summer between the third and fourth years consists in visits to typical mining and metallurgical plants in operation in Nova Scotia. The first week is spent in geological surveying and mapping of some interesting quadrangle. The rest of the time

is spent in practical mine surveying, observation, note taking, and sketching of various metal mining, ore concentration, coal mining, iron smelting or steel works, of which there are splendid examples in this province. Notes and sketches are written up in the evening. A full, neat report with sketches is required to be handed in by the students at the beginning of the autumn semester. Nearly all the students work in the mines in some practical capacity, either in actual mining or surveying, and thus gain experience and aptitude that is invaluable in making their last year's course interesting and vital.

420. ASSAYING.

THIRD YEAR, SECOND SEMESTER, LABORATORY, SIX HOURS PER WEEK.

The purpose of this course is to acquaint the student with the theory and practice of fire assaying, as carried out today. The training prepares the student for the course in metallurgical laboratory where he is required to trace the ore values through the mill runs and metallurgical tests that make up the course. It also prepares him to quickly become an expert assayer after he leaves college, if he starts his engineering practice in such a position.

Lectures are given from time to time covering the following points: assay furnaces, tools, reagents, sampling, weighing, reduction and oxidation reactions, slag formation; the various methods of crucible fusion, scorification, cupellation, parting, and special methods for special ores and metallurgical products.

Reports will be required weekly, and must be kept up to date, otherwise full value for the work cannot be obtained.

The following assays are required:—Reducing power, silver ores by scorification and crucible assay, gold ores by pot and muffle furnace fusion, lead ores by crucible fusion. ores with metallics, base and doré bullion, cyanide solutions, pig or blister copper, special ores and metallurgical products.

TEXT BOOK:

Lodge—"Notes on Assaying."

Books for Study:

Austin—"Fire Assay."

Fulton—"Manual of Fire Assaying."

425. PRINCIPLES OF METALLURGY,

THIRD YEAR, FIRST SEMESTER, LECTURES, THREE HOURS A WEEK.

This course deals with metals, furnaces, fuel sand typical metallurgical processes, agents and products. It serves as an introduction to the course in the second semester of the junior year on metallurgy of non-ferrous metals and also to the course on the metallurgy of iron and steel. The subjects treated will be as given below:

I. Introduction.

a. General introduction with short history of ancient and primitive forms of metallurgy.

b. The common metals and their uses. Also most common ores of the same.

c. Fundamental principles of modern metallurgy. (*a*) Factors necessary for cheap metallurgy. (*b*) Oxidation and reduction. (*c*) Heat utilization and hydro-metallurgy.

II. Physical Properties of the Metals.

Crystalline structure. Density, malleability and ductility. Toughness, brittleness and hardness. Tenacity. Strength. Vapor tension. Boiling and fusing points.

III. Alloys.

Physical mixtures. Solid solutions and analogies. Graphic representation of simple cooling curves and interpretation. Relation between cooling and heating curves. Eutectics and simple micro-structures.

Properties of alloys as compared with respective metals. Representative alloys. Composition and industrial uses of alloys.

IV. Combustion.

Complete and incomplete. Common combustibles, flames, explosion, smoke, contact and radiation. Heating power of fuels, heat units and laws of thermal chemistry, temperature of combustion, calorific power and calorific intensity of solid, liquid and gaseous fuels, heat of combustion, thermal efficiency, calorific measurements, calorimetry, Mahler bomb, Carpenter's, Junker's and Parr's calorimeters.

V. Fuels.

Solid fuels,—Wood, peat, coals, charcoal, coke, and kilns and coke-ovens, briquettes; recovery of bye-products.

Liquid and gaseous fuels,—Petroleums composition and uses; natural and producer gas; different forms of producers; composition of gas, thermal efficiency, recovery of bye-products.

Typical metallurgical operations. Simple outline of typical metallurgical processes, as thermo-metallurgy in blast furnace and hydro-metallurgy in coal washing; slags, mattes and speises, as to fusibility and composition.

VI. Heat Utilization.

Regeneration furnaces, heat balance, sheets of furnaces; different methods of recuperation; design of chimneys and grates, regenerators, recuperators; valves and furnace detail; electric furnaces.

VII. Measurement of High Temperatures.

Mercury and gas thermometers. Wiberg and Frew gas pyrometers. Melting points, electric resistance pyrometers, optical pyrometers, seger cones, practical pyrometry.

VIII. Refractories.

Fire Clays,—Origin, composition and uses; effect of impurities: gannister, silica, graphite, chromite, lime, dolomite, magnesite, bauxite; manufacture of bricks; furnace linings, crucibles; strength testing and general adaptability to different uses.

TEXT BOOK :

Fulton—" Principles of Metallurgy."

BOOKS FOR STUDY :

Roberts-Austen—" Introduction to the Study of Metallurgy."

Sexton—" Fuel."

Sexton—" Alloys."

Damour-Queneau—" Industrial Furnaces."

Goerens—" Introduction to Metallography."

Juptner—" Heat, Energy and Fuels."

426. NON-FERROUS METALLURGY.

THIRD YEAR, SECOND SEMESTER, LECTURES, THREE HOURS A WEEK.

The main principles and modern practice of the metallurgy of the five principal metals are taken up in this course. The metals considered are copper, gold, lead, silver and zinc. The main stress is laid upon copper and gold.

COPPER.

Practice of Roasting Copper Ores : Stall roasting, various forms of modern roasters, as O'Hara, Brown, McDougall, Pearce.

Blast Furnace Smelting : Classification of methods, metallurgical losses, removal of sulphur, calculation of charge, smelting of oxidized ores, modern blast furnaces, handling of materials, flue-dust.

Reverberatory Smelting : Modern reverberatory furnaces, chemistry of the process, modern practice, details of equipment and operation.

Pyrite Smelting : Furnace phenomena, analogy with Bessemerizing, chemistry of the process, slag formation, fuel, influences of earthy bases on slags, modern practice, losses and costs.

Slags: Nomenclature, oxygen-ratio, study of replacement value of bases, effects of various impurities, physical properties of slags.

Production of Metallic Copper from Matte: Principles of matte concentration, Welsh blister process, Bessemerizing of copper matte, Baggaley methods.

Refining of Copper: Effect of impurities, comparative elimination of impurities, electrolytic reduction of copper, furnace refining of copper, refined copper.

Principles of furnace building.

Applications of thermochemistry.

Gold.

Physical and chemical properties of gold, gold compounds and alloys.

Stamp Milling of Gold Ores: Stamp battery and accessories, arrangement of plant, amalgamation, clean-up, retorting, melting, examples of stamp battery practice.

Chlorination Process: Plattner, vat and barrel processes, roasting, chemistry and history of processes, practice at modern mills. Thies process, bromination.

Cyanide Process: Evolution of process, testing of ores for adaptibility to cyanidation: percolation and leaching, dissolution of gold and silver, sources of loss of cyanide, precipitation of gold and silver, by zinc and electricity, clean-up, refining and smelting. Cyaniding plant and accessories for leaching single and double treatment, crushing in cyanide solution. Slimes and slime treatment, agitation and natural settlement, filter pressing, examples of modern practice. Design of cyanide plant and accessories, costs of construction and operation.

Gold Bullion: Refining, various methods of parting, assay on bullion.

Silver.

Physical and chemical properties of silver compounds.

Patio process crushing, treatment of ground ore, separation of amalgam, losses and cost.

The pan process, arrangement of plant, crushing, working of pan charge, types of pans, clean-up pan, handling amalgam, chemistry of process, losses and costs. Boss continuous process; roast-amalgamation process; drying, crushing, chloridizing, amalgamation, Reese River process, chemistry of process, losses and costs.

Chloridizing Roasting: Chloridization of sulphide and non-sulphide ores, hand and mechanical reverbatories, Stetefeldt furnace, losses and costs.

Hyposulphite Leaching Processes: Patera process; roasting, leaching, precipitation, chemistry of process, examples of modern practice; Russell process; chemical action of Russell solution, method of operation, examples of modern Russell plants, refining of reprecipitated sulphides.

Cyanide Leaching Process: Chemical reactions of silver ores in cyanide solutions, crushing, percolation, secondary chemical reactions, losses of cyanide, precipitation of silver by zinc and electric current, slime treatment, filter pressing, arrangement of plant, costs, examples of modern practice.

Lead.

Physical and chemical properties of lead, lead compounds and lead alloys.

Reverberatory Smelting: Ores, fuels and fluxes, Roasting of lead ores, Carinthian, English and Silesian methods.

Roast-Smelt in Pots: History of process, Huntington-Heberlein process, various modifications of process.

Smelting in the Open-Hearth: Mode of working, treatment of slags, recovery of flue dust.

Smelting in Blast Furnace: Lead slags, action of fluxes, fuels, roasting of ores, blast furnace and accessories, chemistry of the blast furnace, calculation of charge, method of operation, irregularities, furnace products, base bullion, speiss, mattes, slag, wall-accretions hearth-accretions, flue-dust and treatment, losses and costs.

Desilverization of Base Bullion: Pattinson process, plant and mode of operation, Luce-Rozan process, Parke's process, plant, mode of operation, softening, liquating, refining, desilverization, skimming, treatment of zinc crusts, distillation, chemical treatment, treatment of by-products such as dross, etc.

Cupellation: German and English methods, furnaces, modes of operation, comparison of methods, losses and costs.

Books for Study.

Schnable-Louis—"Handbook of Metallurgy."

Peters—"Principles of Copper Smelting."

Peters—"Modern Copper Smelting."

Rose—"Metallurgy of Gold."

Julian and Smart—"Cyaniding of Gold and Silver Ores."

Hofman—"Metallurgy of Lead."

Collins—"Metallurgy of Silver."

Ingalls—"Metallurgy and Properties of Zinc."

Austen—"Metallurgy of Common Methods."

427. METALLURGY OF IRON AND STEEL.

FOURTH YEAR, FIRST SEMESTER, LECTURES THREE HOURS PER WEEK.

In this course the metallurgy of iron and steel as carried out to-day is dealt with thoroughly. No obsolete practice is taken up unless deemed necessary for showing the development of a process. Much stress is laid upon metallurgical and thermal chemistry as applied to the iron and steel industry.

Pig Iron: Ores, fuels and fluxes, iron blast furnace and accessories, smelting practice, chemistry of process, calculating blast furnace charge, comparison of processes of purification of pig iron.

Wrought Iron and Crucible Steel: Different processes of making wrought iron, elimination of impurities. Process and plant for making crucible steel, chemistry of processes.

Acid and Basic Bessemer Steel: Plant and modern practice of acid and basic processes, chemistry and thermal efficiency of converters, comparison of two processes.

Acid and Basic Open-Hearth Steel: Open-hearth furnaces and accessories, acid and basic open-hearth practice. Special open-hearth processes, duplex process, chemistry and thermal efficiency of processes.

Mechanical Treatment of Steel:—Forging, rolling, stamping drawing, etc. Rolling Mill practice, heating furnaces.

Iron and Steel Foundry: Making of moulds, design of patterns, cupola furnaces, steel casting practice, malleable castings.

Constitution of Iron and Steel: Solution theory as applied to metals and their alloys, freezing curves, Roozeboom diagram, micro-constituents of iron and steel, metallography of iron and steel, physical properties, effect of impurities on cast iron and steel.

Heat Treatment of Steel: Annealing, hardening and tempering of steel, improper heat treatment, constituents of hardened and tempered steel.

Special Alloy and Steel.

Corrosion of Iron Steels.

Electro-metallurgy of Iron and Steel.

TEXT BOOK:

Stoughton—"Metallurgy of Iron and Steel."

BOOKS FOR STUDY.

Campbell—"Manufacture and Properties of Iron and Steel."

Harbord—"Metallurgy of Steel."

Sexton—"Outlines of the Metallurgy of Steel."

Osmond and Stead—"Microscopic Analysis of Metals."

Howe—"Iron, Steel and other Alloys."

428. METALLURGY OF IRON AND STEEL.

FOURTH YEAR, FIRST SEMESTERS, LECTURES TWO HOURS A WEEK. SHORT COURSE FOR CIVIL, ELECTRICAL AND MECHANICAL ENGINEERS.

This course deals principally with the physical and chemical properties of iron and steel rather than with the metallurgical chemistry and the special machinery used in the various processes of manufacture. A great deal of stress is laid upon the influences of hot working, heat treatment, the effects of the various elements on the physical properties of steel and the writing of specifications for rails, plates, structural steel, etc.

Materials Used in Steel Making:—Ore, fuel, flux.

Manufacture of Pig Iron: Blast furnace, construction and operation, chemical processes involved, chemical and physical properties of cast iron.

Manufacture of Steel: Different processes, acid and basic bessemer, modes of operation, elimination of impurities recarburization, difference between acid and basic processes in operation and product, construction and operation of open hearth furnace producers, coke ovens, heating furnaces, acid open hearth practice, elimination of impurities, recarburization, comparisons of acid and basic processes.

Special Steels: Manufacture of crucible steel, chemical history of crucible melting, high carbon steels in the open hearth furnace, manufacture of steel castings, blowholes, special alloys in the electric furnace.

Wrought Iron: History, mode of production, elimination of impurities, comparison with soft steel.

Foundry Work: Different classes of molds, cupola furnaces methods of casting, malleable castings.

Mechanical Treatment: Segregation and homogeneity soaking pits, rolling of steel, reheating furnaces, influence of hot working on steel, percentage decrease in passes, effects of thickness upon the physical properties of rolled shapes, forging, hydraulic press.

Heat Treatment: Annealing, working temperature, quenching, hardening, tempering, influence of hot and cold working, relation of work and temperature, effects of work on structure of rails, structural shapes, etc., effects of heat treatment on various classes of steel.

Effects of Various Elements in Steel: Influence of carbon, silicon, manganese, sulphur, phosphorus, nickel, tungsten, vanadium, chromium, etc., on the physical properties of steel.

Structural Steel: Steel a solution of various elements in iron, analogies in physical chemistry, critical points, microstructure of steels, theories regarding the structure of steel.

Specifications: Chemical and physical specifications for structural steel, rails, boiler plate, rods, etc., methods of testing.

TEXT-BOOK.

Stoughton—"Metallurgy of Iron and Steel."

Books for Study.

Harbord—"Metallurgy of Steel."

Campbell—"Manufacture and Properties of Steel."

403. METALLURGICAL LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, LABORATORY EIGHT HOURS A WEEK.

This consists of metallurgical and mill tests and reports. Some of the tests are merely illustrative of processes and some are made with half-size regular furnaces and mill apparatus. Full reports are required in every case, within two weeks after the completion of an experiment or test. A large amount of assaying is necessary in determining the distribution of values and losses in the products made in the different tests and this makes the student more proficient as an assayer.

Most of the following tests are carried out by the students in the fourth year.

High temperature measurement. Determination of the calorific power of fuels. Temperature limits of hardening power of steel. Oxidizing roast of a sulphide ore. Melting points of silicates. Corrosion of refractories by silicates, Copper selecting process. Chloridizing roast, barrel chlorination process. Cyanide process, leaching and slime treatment. Gold amalgamation test. Silver pan amalgamation. Lead or copper smelting in the blast furnace. Cupellation of base bullion. Refining of copper. Gold stamp mill run. Concentration by jigging with previous sizing and with classification. Wilfley table concentration. Vanner concentration.

450. EXPLORATION AND EXCAVATION.

THIRD YEAR, SECOND SEMESTER, LECTURES, FIVE HOURS A WEEK.

This course serves as an introduction to engineering as applied to mining. Problems are introduced into the work wherever possible. A syllabus of the material treated is nearly as follows :—

Prospecting: Value of geology in prospecting, surface indications, trenching, trial pits, special indications of copper, iron, gold, zinc, coal, etc., prospecting for gold by glacial indications in Nova Scotia.

Boring: Well-augur, American oil well borer, Keystone driller, Mather and Platt's system, boring by percussion with rods, diamond drilling, calyx drill.

Compressed Air Machinery: Wet compressors, special machines for high pressure, valve details of various makes, indicator air-cards, duty and efficiency, receivers, pipe lines, various types of air drills as Darlington, Ingersoll, Rand, Sullivan, McKeirnan, Leyner, etc., Electric drills, coal undercutting machines of puncher, disc, and chain types, tunneling machines, compressed air locomotives, compressed air auxiliary engines for hoisting, etc.

Explosives: Gunpowder, composition high explosives, such as gun cotton, nitroglycerin, dynamites, blasting gelatine, etc., Sprengel explosives, fulminates, "permitted" explosives, cartridges, detonators, fuses, care of explosives, theory of blasting, methods of drilling for excavations, electric machines for firing.

Shaft and Slope Sinking: Methods of drilling, firing and sinking, different methods of supporting circular and rectangular shafts, shaft timbering details, special methods of sinking in running ground, forepoling, sinking shoe with brick or concrete lining, tubbing, Poetsch freezing process, Kind-Chaudron process, caissons.

Supporting Excavations: Timber preservation, various methods of supporting levels with timber, special timbering for soft ground, Nevada square set methods, masonry and steel supports.

Hydraulic Mining and Dredging: Prospecting placer ground, general consideration of dams, flumes, and ditches, special apparatus and practice in hydraulic mining, dredging machines, modern dredging practice, metallurgy and costs of dredging.

BOOKS FOR REFERENCE.

Foster—"Textbook of Ore and Stone Mining."
"Coal and Metal Mining Pocketbook."

Peele—"Compressed Air Plant for Mines."

Guttmann—"Blasting."

DeKalb—"Manual of Explosives."

Storms—"Timbering and Mining."

Weatherbe—"Dredging for Gold in California."

451. EXPLOITATION, HAULAGE AND PUMPING.

FOURTH YEAR, SECOND SEMESTER, LECTURES, THREE HOURS A WEEK.

Exploitation: Opening up of deposits, choice of plan of working, shaft versus slope, adits, overhand and underhand stoping. Methods of working ore bodies, working out beds with permanent and with temporary pillars, pillar robbing, caving system, slicing methods, milling method, system of filling, special methods applied to masses and thick ore bodies.

Special Methods of Working Coal: Bord and pillar systems and various modifications, long wall, working steep seams, working contiguous seams, shaft pillars, subsidence, submarine mining, spontaneous combustion.

Haulage: Cars, tracks, animal haulage, steam, air and electric locomotive haulage, comparative costs. Wire rope haulage systems; details, adaptibility, comparative cost of endless rope and main tail rope, aerial tramways. Hoisting, winch, windlass, whim. Power machinery for hoisting; steam engines for hoisting, first, second and third motion geared engines, use of water wheels, gasolene engines and electric motors for hoisting. Cylindrical and conical drums, reels, various forms of hand, steam and automatic brakes, methods and calculations for compensation, calculations for size of hoisting engine, Koepe and Whiting systems. Ropes, rope cappings, buckets, skips, cages; pulleys, detaching hooks, safety clutches, keps, surface and underground arrangement of hoisting plant.

Haulage: Rails, turntables and other haulage plant accessories. Details of mine tubs. Horses, stables, and costs. Self-acting inclines, back-balances and details of apparatus. Direct acting haulage. Main and tail-rope haulage. Endless rope, haulage, haulage engines, special methods of haulage in coal mining.

Head frame and accessories, skips, tanks, and cages, ropes, guides, etc. Hoisting engines, calculation for size of engines, counterbalancing. Special systems for winding from great depths. Special methods of winding in coal mines.

Pumping: Origin of underground water, drainage through adits. Cornish pumping engine and pumping details, general arrangement in shaft efficiency, steam and compressed air pumps; piston and plunger, inside and outside packed, duplex pumps, differential plunger pumps, compound and triple expansion pumps, power driven pumps, centrifugal pumps, Frenier pumps, bucket lifts, pulsometers, air lift, rotary pumps, different pump valve gears as Cameron, Blake, Knowles, Worthington, costs. Dams, Installation of Pumping Plants.

Special Pumping Machinery in Coal Mining—"Special pumping machinery and accessories for pumping in coal mines.

BOOKS FOR STUDY.

Foster—"Text-book of Ore and Stone Mining."
Richards—"Mining Notes."
Ihlseng—"Manual of Mining."
Hughes—"Text-book on Coal Mining."
International Text-book Co.—"Coal Mining."
Boulton—"Practical Coal Mining."
Mayer—"Mining Methods in Europe."
Hoover—"Principles in Mining."

452. VENTILATING, LIGHTING, ACCOUNTING AND VALUATION.

FOURTH YEAR, SECOND SEMESTER, LECTURES FOUR HOURS A WEEK, FOR TWELVE WEEKS.

Ventilation: Gases met with in mines, coal-dust, laws of friction, theory of air currents, mechanical ventilators, details of different types, fan engines, motors and methods of connection, secondary ventilation, useful effect, efficiency. Stoppings, doors, brattice, regulators, air-crossing, losses in circulation, theory of splitting, problems. Testing for various gases, explosive mixtures, natural ventilation, ventilation by furnace, water blast

and steam jets, fan ventilation; various types of fans as Guibal, Schiele, Capell, Nasmyth, Murphy, Waddle and Rateau. Manometric efficiency. Production of air currents, regulators, laws of friction, splitting of air currents, calculations relative to splitting, equivalent orifice, orifice of a passage, summation of orfice in series, graphic method of orifices, mine explosions, mode of procedure to recover miners and mine, rescue breathing apparatus, mine fires, cause and methods of suppression or exclusion.

Lighting: Candles, torches, acetylene lamps. Naked lights, electric lighting. History of development of safety lamps. Modern lamps such as Ashworth-Heppelwhite, Muesseler, Marsaut, Wolf, Morgan, etc. Underground lighting stations. Delicate indicators as Pieler, Chesneau, Stokes, Ashworth, Shaw.

Accounting: Cashbook, journal and ledger, and how to keep them. Distribution of expense and segregation of costs. Prime cost, maintenance, mine development and depreciation, renewal fund, sinking funds.

Valuation: Sampling a mine, contamination of samples, calculation of results, estimation of probable value, examples.

Books for Study.

Foster—"Textbook of Ore and Stone Mining."
Richards—"Mining Notes."
Ihlseng—"Manual of Mining."
International Text-book Co..—"Coal Mining."
Coal and Metal Miners' Pocket-book.
Boulton—"Practical Coal Mining."
Wallace—"Simple Mine Accounting."
Rickard—"Sampling and Estimation of Ore in Mine."
Hoover—"Principles of Mining."

453. ORE DRESSING.

FOURTH YEAR, FIRST SEMESTER, LECTURES, THREE HOURS PER WEEK.

It is the purpose of this course to acquaint the student with the general theory and principles that underlie the modern

practice of ore dressing. The theories and principles are illustrated by machines and mills that represent the most advanced methods of the preparation of ores and the extraction of their values. The different types of machines are criticized and also the combinations of machines that represent different milling practices.

Breaking: Crushing, comminuting.

Preliminary: Crushing, breakers, rolls, steam and gravity, stamps, pulverizers, laws of crushing.

Separating: Concentrating, washing.

Preliminary washers: Sizing, screens and principles of screen-sizing, classifiers, laws of classifying by free settling in water, hand-picking, jigs, laws of jigging, fine sand and slime concentrators, amalgamation, magnetic concentration, pnuematic concentrators, miscellaneous processes of separation.

Accessory Apparatus: Bins, receiving floors, samplers, feeders, distributors, conveyors, elevators, and wheels, pumps launders, unwaterers, miscellaneous apparatus.

Surface Plant: Power house and distribution, plant arrangement, tipplers, screens, conveyors, bins, chutes, coal washing plant and accessories, Robinson, Coppee and Baum machines, coal washing jigs and tables.

Mill Processes and Management: Summary of principles of separation, study of different classes of milling practice from typical mills.

General Ideas on Milling: Mill location, construction of buildings, power, power transmission, ventilation, lighting, labor, water, disposal of products, percentage extraction, limit of concentration, accounts and reports, losses and costs, testing an ore for a process.

TEXT BOOK.

Richards—"Ore Dressing."

460. MILL CONSTRUCTION.

FOURTH YEAR, FIRST SEMESTER, LECTURES, FIVE HOURS A WEEK FOR SIX WEEKS.

This course treats of the construction and equipment of mill and smelter buildings. It will include information on such

structures as are required for sampling plants, ore concentration, steel mills, stamp mills, copper and lead smelters, etc.

Attention will be given to such practical details as are outlined.

Erecting building and machinery foundations, concrete construction, wooden and steel mill construction, saw-toothed roof construction, head frames, trusses and trestles, coal tipples, roof coverings, laying out shafting, pulleys, belts, and belting, erection of machines, pipe-fitting, setting of boilers, setting of turbines, lighting of mill buildings, protection of iron and steel from corrosion, cost of foundations, retaining walls, erection of buildings, installation of machinery, maintenance, depreciation.

Mechanism, mechanical powers, shafts, couplings, bearings, clutches, transmission of power by belts, ropes, friction gears, chains and cams.

Books for Reference.

Kidder—"Architects' and Builders' Pocket-Book."

Hobart—"Mill-wrighting."

Ingalls—"Notes on Metallurgical Mill Construction."

461. MINE PLANT DESIGN.

FOURTH YEAR, FIRST AND SECOND SEMESTERS, DRAFTING, SIX HOURS A WEEK.

In this course the student is required to design some actual small plant or some portion of a large plant as would be necessary in the development of mining or metallurgical enterprise. Working drawings of some such plant as a stamp mill, steel or wooden head frame, concentration plant, smelter building, skip, cage, head frame, ore bin, tank head, etc., are prepared. The drawings must be supplemented also by bills of material, specifications and estimates.

465. THESIS.

FOURTH YEAR, SECOND SEMESTER, LABORATORY, NINE HOURS A WEEK.

This consists in an elementary, original investigation into some mining or metallurgical problem. This will acquaint the student with the methods of scientific investigation so that he will know how to tackle problems that arise in engineering work. The student must choose his subject before the end of the first semester of the fourth year. He must prepare a card catalogue and abstracts of the literature bearing on his problem and prepare a thorough complete report on the work in acceptable form.

500. MILITARY SCIENCE AND DRILL.

THIRD YEAR, FIRST AND SECOND SEMESTERS, TWO HOURS A WEEK.

SYLLABUS:

October and November:

Military Engineering comprising bridging, rafting, earth work, etc.

TEXT-BOOKS:

"Manual Military Engineering, 1905;" "Field Service Pocket book, 1907."

December and January:

Canadian Military Organization Tactics as outlined in Manual of Combined Training.

February:

Military History.

TEXT-BOOKS:

C. P. Lucas—"Canadian War, 1812."

Sir Jas. Carmichael Smyth—"Precis of Wars in Canada."

March, April and May:

Military Engineering, Defence of Posts, villages, obstacles, etc.

TEXT-BOOKS.

"Manual of Military Engineering, 1905."

"Map Reading and Reconnaissance."

"Manual of Map Reading and Field Sketching, 1906."

Military and Physical drill two half-hour exercises a week, throughout the year.

490. CONTRACTS AND SPECIFICATIONS.

FOURTH YEAR, SECOND SEMESTER, LECTURES FIVE HOURS A WEEK FOR THREE WEEKS.

General law of real estate, personal and employers liability, law of engineering contracts, provincial and Dominion of Canada mining law, as compared with that of the United States and Mexico, Nova Scotia Coal Mines Regulation Act.

LAND SURVEYING.

TWO MONTHS, JANUARY AND FEBRUARY.

This course in land surveying is intended for beginners who wish to qualify themselves for Provincial Land Surveying. It will cover the following range of subjects.

1. Study of common surveying instruments, such as compass, level, and transit.
2. Adjustment of these instruments.
3. Use of these instruments in making land surveys.
4. Approved methods of keeping field notes.
5. Office calculations based on field notes.
6. Methods of mapping surveys of land.
7. Determination of true north.
8. Topographic surveying and plotting.

It is expected that the student should acquire the ability to survey quickly and independently any ordinary piece of farm, or timber land or mining area. It is also expected that he shall learn how to do the ordinary office calculations quickly and accurately, make neat accurate plans of surveys, and to be able to describe and mark the boundaries of any certain area

surveyed by him, so that there is no possibility of a misunderstanding arising afterward in this connection. It is necesary for the applicant to have a fair working knowledge of English composition and plane trigonometry.

A detailed outline of the different subjects as taught in the lectures, recitations, problems, and field work is as follows:—

Measurement of lines by pacing, chaining, or taping; angular measurements with hand compass; verniers and their uses in linear and circular measurements; the compass and its use in surveying; bearing and azimuths; delination of the magnetic needle, and its variations; dip of needle; the transit, its adjustments and it uses; errors, their source and prevention, field notes, and office calculations; traverses, latitude and departure, checks; methods of plotting, parting of land; re-running of old lines, methods of locating a point; passing obstacles; other difficulties met in surveying practice; highway surveys; leveling; datum; form of notes; check hand level and its uses: Wye and Dumpy levels, care and adjustment; leveling-rod, target and vernier; difficult leveling; profile leveling; leveling for drainage and highways; computation of earthwork; determination of true north—determination by observation on polaris, solar attachment, use of nautical almanac, determination by observation on sun.

TOPOGRAPHIC SURVEYING.

Topographic Surveying; Lectures, Recitations and Field Work.

Topographic maps, and their value; methods of topographic surveying; contours; contour intervals. Triangulation; base-line, etc. Stadia surveying; stadia wires; stadia rods; value of stadia in topographic work; reduction of readings.

Mapping modern office methods, use and care of drawing instruments, lettering plotting, plotting of lands by both length and bearings, plain and topographic mapping, contouring, conventional signs, tracing, blue printing, uses of planimeter and pantograph.

Organization, and equipment of field parties, and duties of members.

The fee for this course will be fifteen dollars, ($15.00) payable in advance. The entire equipment of the department of Civil Engineering will be available for this course.

HIGHWAY CONSTRUCTION.

SHORT COURSE, TWO WEEKS IN FEBRUARY.

This course is free. It is designed especially for road inspectors and road superintendents, and all others who are vitally concerned in the construction and maintenance of rural highways. The public is demanding good roads in Nova Scotia. The government is getting ready to spend large sums of money in rural highway construction, Everyone who is to be or wants to be connected with this great piece of work, should take advantage of this course in the Technical College in Halifax this winter.

The course will be as practical as possible and will not be too technical for any one to follow and profit by. Theory will be left in the back ground as much as possible, and the course will deal with actual construction and results. Special attention will be laid on the costs of various operations, and various kinds of construction. Some practical outside work will be done in learning the use of the hand level in laying out grades and in testing different road materials.

An outline of the course follows :—

Value of Good Roads.—Why a large expenditure on rural highways is justified, advantages of good roads to farmer, merchant and province, comparison of wagon haul and rail road haul.

Location of Highways.—The first important thing in highway construction is to get the proper location. The different factors such as cost, grades, amount of traffic, etc., will be carefully considered in regard to the profitableness of locating a new road or re-locating an old road. The effects of steep grades on the limits of hauling loads, as well as the cost of maintenance will be studied.

Road Building.—The three main points are foundation, drainage, and surface.

1. Foundation :—Materials such as sand, clay, and loam ; treatment of different foundation materials ; shaping.

2. *Drainage.*—Surface drainage, ditching and crown ; underground drainage.

3. *Surface.*—Materials, sand, clay, gravel and stone ; sand clay roads ; clay sand roads ; gravel and stone roads, width and thickness of surfacing material preparation of earth foundation, laying surfacing material, rolling and sprinkling, oiling.

Macadam roads.—Materials, test on available materials, different methods of construction, width, grades, cross sections, destructive agents, patching, sprinkling, oiling, effects of automobiles, costs of construction and maintenance.

In all of the above operations, the costs are carefully considered.

Road Maintenance —Effect of wide tires, earth road drag in its various forms, section system of maintenance.

Road Machinery.—The different kinds of road machinery are carefully studied from the catalogues of the manufacturers. The kind of work for which each is suited is gone into with great care.

Culverts.—Wooden poles, timber, iron, tile, concrete, comparative costs of construction and upkeep ; advantages of different materials, comparative life and how different kinds of materials may be used to obtain the best results.

Small Bridges.—What small bridges may be constructed by road superintendents and what ones should be designed by experts ; the various points considered are :—(1) Location, (2) Size of opening, (3) Materials, (4) abutments, (5) Costs.

Road Administration.—Practice in using hand level, engineers level, compass and in drawing.

Fees.—This class is free to everybody.

Engineering Camp.
Three weeks field practice in camp the preceding summer.

CIVIL ENGINEERING.

THIRD YEAR. FIRST SEMESTER.

	SUBJECTS	Reference No.	Credits	Weeks	Hours Per Week: Expected Preparation	Hours Per Week: Lectures and Class Works	Hours Per Week: Field Lab. or Drafting	For Details See: Page	For Details See: Course No.	Pre-Requisites
1	Mechanics of Engineering I ...	Mechanics 1	5	15	10	5	.....	17	101	Third year entr. requirements
2	Railway Location.....	Civil Eng. 2	2	First 6	10	5	.....	12	121	Third year entr. requirements
3	Ry. Construction & Maintenance	Civil Eng. 3	3	Last 9	10	5	.....	22	122	121
4	Thermodynamics.....	Thermos. 1	5	15	10	5	.....	37	301	Third year entr. requirements
5	Mech. Engineering Laboratory	Mech.Eng. 3	2	15	1	.....	3	39	310	Concurrent with 301
6	Electrical Machinery.....	Elec. Eng. 1	3	15	6	3	.....	31	201	Third year entr. requirements
7	Elec. Engineering Laboratory .	Elec. Eng. 3	2	15	1	.....	3	35	210	Concurrent with 201
8	Drafting & Advanced Surveying	Civil Engr. 1	4	15	1	.....	9	21	120	Third year entr. requirements
9	Military Science and Drill.....	Mil. Sci. 1	1	15	1	1	1	73	500	.....
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THIRD YEAR. SECOND SEMESTER.

	SUBJECTS	Reference No.	Credits	Weeks	Hours Per Week: Expected Preparation	Hours Per Week: Lectures and Class Works	Hours Per Week: Field Lab. or Drafting	For Details See: Page	For Details See: Course No.	Pre-Requisites
1	Mechanics of Engineering II ..	Mechanics 2	3	First 9	10	5	.....	18	102	101
2	Graphic Statics.....	Mechanics 4	2	Last 6	10	5	.....	19	105	101
3	Materials Testing	Mechanics 3	2	15	1	.....	3	19	103	Concurrent with 102
4	Theoretical Hydraulics.....	Hydraulics 1	3	First 9	10	5	.....	20	111	101
5	Roads and Pavements.....	Civil Eng. 4	2	Last 6	10	5	.....	24	131	Third year entr. requirements
6	Hydraulics Testing.....	Hydraulics 2	2	15	1	.....	3	20	112	Concurrent with 111
7	Electrical Machinery.....	Elec. Eng. 4	3	15	6	3	.....	31	201	Third year entr. requirements
8	Elec. Engineering Laboratory..	Elec. Eng. 5	2	15	1	.....	3	35	210	Concurrent with 201
9	Military Science and Drill.	Mil. Sci. 2	1	15	1	1	1	73	500	.....
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FOURTH YEAR. FIRST SEMESTER.

	SUBJECTS	Reference No.	Credits	Weeks.	Hours Per Week.			For Details See		PRE-REQUISITES
					Expected Preparation.	Lecture and Class Work	Field Lab. or Drafting	Page	Course No.	
1	Masonry Construction—Arches, Dams, Foundations and Reinforced Concrete	Civil Engr. 7	5	15	10	5	.....	24	141	102, 105, 111, 120
2	Materials Testing	Civil Engr. 8	2	15	1	.....	3	25	142	Concurrent with 141
3	Water Supply	Civil Engr. 10	3	Last 9	10	5	.....	26	151	102, 111, 301
4	Water Supply Design	Civil Engr. 11	1	Last 7½	.....	.....	6	26	152	Concurrent with 151
5	Railway Structures	Civil Engr. 5	2	First 7½	2	.....	6	23	124	121, 123, 122
6	Ry. Field Work (Summer Work)*	Engr. Camp	...	3	.....	.....	48	23	123	121, 122
7	Roofs and Bridges	Civil Engr. 15	2	First 6	10	5	.....	29	171	102, 105
8	Roofs and Bridges	Civil Engr. 16	3	15	.....	.....	9	29	172	Concurrent with 171
9	Geology	Geology 3	3	15	4	2	3	54	407	.....
10	.....	.....	...	.....	.....	.....	.....	....	....	.....
11	.....	.....	...	.....	.....	.....	.....	....	....	.....

FOURTH YEAR. SECOND SEMESTER.

	SUBJECTS	Reference No.	Credits	Weeks.	Hours Per Week.			For Details See		PRE-REQUISITES
					Expected Preparation.	Lecture and Class Work	Field Lab. or Drafting	Page	Course No.	
1	Hydraulic Engineering	Hydraulics 3	3	First 9	10	5	.....	27	153	111
2	Masonry and Reinforced Concrete Design	Civil Eng. 9	2	First 4	.....	.....	24	25	143	141
3	Sewerage	Civil Eng. 12	3	First 9	10	5	.....	27	161	102, 111, 151
4	Sewage Disposal and General Sanitation	Civil Eng. 13	2	Last 6	10	5	.....	28	162	161
5	Sewer Design	Civil Eng. 11	1	Last 2	.....	.....	24	28	163	161
6	Bridge Design	Civil Eng. 17	5	5th to 13th incl.	.....	.....	25	30	173	171, 172
7	Tunnelling	Civil Eng. 6	1	10th to 12th incl.	10	5	.....	23	125	301, 102, 111, 141, 122
8	Metallurgy	Metallurgy 7	2	.....	.....	.....	.....	42	410	.....
9	Contracts and Specifications	Contracts	1	Last 3	10	5	.....	30	191	Preceding work of fourth year
10	.....	.....	...	.....	.....	.....	.....	....	....	.....
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FIRST SEMESTER. ELECTRICAL AND MECHANICAL ENGINEERING. THIRD YEAR.

		Reference No.	Credits	Weeks	Hours Per Week			For Details See		Pre-Requisites
					Preparation	Lecture and Class Work	Field and Lab. Drafting	Page	Course No.	
1	Electrical Machinery	Electrical Eng.....1	3	15	16	3	.....	31	201	Third year entrance.
2	Electrical Laboratory	Electrical Eng.....2	2	15	2	1	3	35	210	Concurrent with 201.
3	Thermodynamics	Thermo 1	5	15	10	5	.....	37	301	Third year entrance.
4	Electrical Eng. Abstracts	Electrical Eng.....2	1	15	2	1	.....	33	203	Third year entrance.
5	Mechanical Eng. Laboratory	Mechanical Eng...3	2	15	1	.....	3	39	310	Concurrent with 301.
6	Mechanics of Engineering, I	Mechanics..... 1	5	15	10	1	.....	40	101	Third year entrance.
7	Military Science and Drill	Military Science...1	1	15	1	5	1	73	.....	.....
8	Machine Drawing and design	Mechanical Eng...1	2	15	.....	.....	6	40	331	Third year entrance.
9	Machine Design	Mechanical Eng...2	3	15	6	3	.....	39	330	Third year entrance.
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SECOND SEMESTER.

		Reference No.	Credits	Weeks	Hours Per Week			For Details See		Pre-Requisites
					Preparation	Lecture and Class Work	Field and Lab. Drafting	Page	Course No.	
1	Electrical Machinery	Electrical Eng.....4	3	15	6	3	.....	31	201	Third year entrance.
2	Electrical Laboratory	Electrical Eng.....5	2	15	2	.....	3	35	210	Concurrent with 201.
3	Steam Machinery	Thermo.....2	2	Last 6	10	5	.....	38	302	301.
4	Electrical Eng. Abstracts	Electrical Eng.....6	1	15	2	1	.....	33	203	Third year entrance.
5	Mechanical Eng. Laboratory	Mechanical Eng...4	2	15	2	.....	3	39	310	Concurrent with 302.
6	Mechanics of Eng II	Mechanics.....2	3	1st. 9	10	5	.....	40	102	101.
7	Materials Testing	Mechanics.....3	2	15	1	.....	3	41	103	Concurrent with 102.
8	Theoretical Hydraulics	Hydraulics.....1	3	1st. 9	10	5	.....	41	111	101.
9	Hydraulic Testing	Hydraulics.....2	2	15	1	.....	3	42	112	Concurrent with 111.
10	Graphic Statics	Mechanics.....4	2	Last 6	10	5	.....	41	105	101.
11	Military Science and Drill	Military Science...2	1	15	1	1	1	73	.....	.....
12	Machine Design and Drawing	Mechanical Eng...5	2	15	.....	.....	6	40	331	.....
13	.....	.....	...	.....	.....	.....	.....	.....	.....	.....

		Reference No.	Credits.	Weeks	Hours Per Week			For Details See		Pre-Requisites
					Preparation	Lecture and Classs Work	Field and Lab.	Page	Course No.	
1	Alternating Currents and Machinery	Electrical Eng.....7	5	15	10	5	?	32	202	201
2	Electrical Engineering Laboratory	Electrical Eng.....8	2	15	2	.....	3	36	211	210
3	Mechanical Engineering Laboratory	Mechanical Eng...6	2	15	2	.....	3	39	311	310
4	Electrical Abstracts	Electrical Eng.....9	1	15	2	1	....	33	203	.....
5	Storage Battery Engineering	Electrical Eng....10	3	First 9	10	5	....	37	212	321
6	Machine Design	Mechanical Eng...7	2	Last 6	10	5	....	49	312	330
7	Steam Power Plants	Mechanical Eng...8	2	First 6	10	5	....	45	303	301–302
8	Electrical Distribution	Electrical Eng....19	3	Last 9	10	5	....	33	205	201
9	Machine Design Drawing	Mechanical Eng...9	2	15	.....	.....	6	40	332	330
..	.....	.....	...	.....	.....	.....	....	.....	.....	.....
..	.....	.....	...	.....	.....	.....	....	.....	.....	.....
..	.....	.....	...	.....	.....	.....	....	.....	.....	.....
..	.....	.....	...	.....	.....	.....	....	.....	.....	.....

SECOND SEMESTER.

		Reference No.	Credits.	Weeks	Hours Per Week			For Details See		Pre-Requisites
					Preparation	Lecture and Class Work	Field and Lab.	Page	Course No.	
1	Alternating Currents and Machinery	Electrical Eng....11	5	15	10	5	....	32	202	201
2	Electrical Engineering Laboratory	Electrical Eng....12	2	15	2	.....	3	36	211	210
3	Electrical Engineering Abstracts	Electrical Eng....13	1	15	2	1	....	33	203	.....
4	Electrical Measurements and Photometry	Electrical Eng....14	3	First 7	10	5	6	35	209	207
5	Electrical Distribution	Electrical Eng....15	3	First 8	10	5	....	33	205	201
6	Electric Railways	Electrical Eng....16	2	Last 6	10	5	....	33	206	203
7	Electric Design Problems	Electrical Eng....17	2	Last 8	.....	.....	6	34	207	205
8	Hydraulics	Hydraulics..... 3	3	First 9	10	5	....	27	153	111
9	Metallurgy	Metallurgy.....	2	15	4	2	....	42	410	.....
10	Contracts and Specifications	Contracts.....	1	15	2	1	....	52	220	.....
..	.....	.....	...	.....	.....	.....	....	.....	.....	.....
..	.....	.....	...	.....	.....	.....	....	.....	.....	.....
..	.....	.....	...	.....	.....	.....	....	.....	.....	.....

FIRST SEMESTER. MECHANICAL ENGINEERING. FOURTH YEAR.

		Reference No.	Credits	Weeks	Hours Per Week.			For Reference See		Pre-Requisites
					Preparation	Class and Lectures	Field Lab. Drafting	Page	Course No.	
1	Steam Power Plants	Mechanical Eng. .. 8	2	First 6	10	5	.....	45	303	301-302
2	Steam Turbines	Mechanical Eng. . .10	2	Last 6	10	5	.....	46	304	.....
3	Gas Engines	Mechanical Eng. . . 11	3	First 9	10	5	....	46	305	.....
4	Electrical Distribution	Electrical Eng. 19	3	Last 9	10	5	.....	51	205	201
5	Machine Design	Mechanical Eng. . . . 7	2	Last 6	10	5	.....	48	332	330
6	Machine Design Drawing	Mechanical Eng. . . . 8	2	15	.....	.....	6	49	332	330
7	Heating and Ventilating	Mechanical Eng. . . .12	3	First 9	10	5	.....	48	322	321
8	Mechanical Eng. Abstracts	Mechanical Eng. . . .13	1	15	2	1	.....	47	306	.....
9	Mechanical Eng. Laboratory	Mechanical Eng. . . . 6	3	15	2	.....	6	48	311	310
10	Electrical Eng. Laboratory	Electrical Eng. 8	2	15	2	.....	3	52	211	210
..	.....	.....	...	.....	.....	.....	.....	.....	.....	.....
..	.....	.....	...	.....	.....	.....	.....	.....	.....	.....
..	.....	.....	...	.....	.....	.....	.....	.....	.....	.....

SECOND SEMESTER.

		Reference No.	Credits	Weeks	Hours Per Week.			For Reference See		Pre-Requisites
					Preparation	Class and Lectures	Field Lab. Drafting	Page	Course No.	
1	Steam and Gas Power Plants	Mechanical Eng. . . 14	5	15	8	4	.....	45	303	301-302
2	Metallurgy	Metallurgy 7	2	15	4	2	.....	42	410	.....
3	Steam Boilers	Mechanical Eng. . . .15	2	Last 6	.....	.....	6	47	307	.....
4	Electrical Distribution	Electrical Eng. 15	3	Last 8	10	5	.....	51	205	.....
5	Machine Design and Drawing	Mechanical Eng. . . 16	3	First 7	10	5	6	49	332	.....
6	Hydraulics	Hydraulics 3	3	First 9	10	5	.....	27	153	111
7	Mechanical Laboratory	Mechanical Eng. . . .17	2	.....	.....	.....	3	48	311	310
8	Mechanical Eng. Abstracts	Mechanical Eng. . . .18	1	.....	.....	.....	.....	47	306	.....
9	Electrical Laboratory	Electrical Eng. 12	2	.....	.....	.....	3	52	211	.....
10	Design Problems	Mechanical Eng. . . .19	2	Last 8	.....	.....	6	49	334	.....
11	Contracts and Specifications	Contracts	1	15	.....	.....	.....	52	220	.....
..	.....	.....	...	.....	.....	.....	.....	.....	.....	.....
..	.....	.....	...	.....	.....	.....	.....	.....	.....	.....

THIRD YEAR. MINING ENGINEERING. FIRST SEMESTER.

Engineering Camp three weeks field practice.

SUBJECTS.	Reference No.	Credits	Length Weeks	Hours Per Week.			Reference		Pre-Requisites.
				Preparation.	Class Work	Field Lab. or Drafting	Page	Course No.	
Mechanics of Engineering 1	Mechanics 1	5	15	10	5	.....	17	101	Third year entrance
Thermodyamics	Thermo. 1	5	15	10	5	.....	37	301	Third year entrance
Applied Geology	Geology 1	3	15	4	2	3	55	405	Third year entrance
Quantitative Analysis	Chemistry 1	4	15	2	1	.....	53	400	Third year entrance
Principals of Metallurgy	Metallurgy 1	3	15	6	3	.....	58	425	Third year entrance
Mine Surveying	Mining Eng 1	2	15	2	1	3	56	415	Third year entrance
Mechanical Engineering Lab	Mil. Science 1		15				47	310	Third year entrance
Military Science aud Drill	Mech. Eng. 3	1	15	1	1	1	73	500	Third year entrance
.....	.....	....	.....	.....	.....	.....	.....	.....	....

THIRD YEAR SECOND SEMESTER.

SUBJECT.	Reference No.	Credits	Length Weeks	Hours Per Week.			Reference		Pre-Requisites
				Preparation.	Class Work	Field Lab. or Drafting	Page	Course No.	
Mechanics of Engineering	Mechanics 2	3	First 9	10	5	.....	18	102	101
Graphic Statics	Mechanics 3	2	Last 6	10	5	.....	19	105	101
Steam Machinery	Thermo. 2	4	15	6	3	3	38	302	.....
Assaying	Chemistry 3	2	15	.....	.....	6	57	420	Third year entrance
Exploration and Excavation	Mining Eng. 2	3	15	10	5	.....	66	450	Third year entrance
Quantitative Analysis	Chemistry 2	3	15	.....	.....	9	55	405	Third year entrance
Non-Ferrous Metallurgy	Metallurgy 2	3	15	6	3	.....	60	426	A 25
Mineralogy	Geology 2	2	15	4		5	54	406	Third year entrance
Military Science and Drill	Mil. Scieuce 2	1	15	1	1	1	73	500	.....

FOURTH YEAR. MINING ENGINEERING. FIRST SEMESTER.

Summer School in Mining Four to Six Weeks.

SUBJECTS.	Reference No.	Credits.	Length Weeks	Hours Per Week.			Reference		Pre-Requisites
				Preparation.	Class Work	Field Lab. or Drafting	Page	Course No.	
Dynamo Electric Machines	Elec. Eng. 18	4	15	6	3	3	31	201	.....
Testing and Materials	Civil Eng. 4..	2	15	1	.....	3	25	142	.....
Mill Construction	Mining Eng. 4	2	First 6	10	5	.....	71	460	101
Metallurgy of Iron and Steel	Metallurgy 3..	3	Last 9	10	5	.....	63	427	425, 426
Metallurgical Laboratory	Metallurgy 4..	3	15	1	.....	8	66	430	400, 420
Mine Plant Design	Mining Eng. 5	2	15	.....	.....	6	72	461	101, 102, 105
Economic Geology	Geology 3....	2	15	6	2	.....	54	407	405, 406,
Ore Dressing	Metallurgy 5..	3	15	6	3	.....	70	453	406

SUBJECTS.	Reference No.	Credits.	Length Weeks	Hours Per Week.			Reference		Pre-Requisites
				Preparation.	Class Work	Field Lab. or Drafting	Page	Course No.	
Theoretical Hydraulics	Hydraulics 1..	3	First 9	10	5	.....	20	111	101
Exploita. Haulage and Pumping	Mining Eng. 3	3	15	6	3	.....	68	451	450
Hydraulics Testing	Hydraulics 2..	2	15	1	.....	3	20	112	Concurrent with 111
Metallurgical Laboratory	Metallurgy 6..	3	15	1	.....	8	66	403	400, 420
Ventilation, Accounts, Valuation	Mining Eng. 7	3	15	6	4	.....	69	452	451
Mine Plant Design	Mining Eng. 6	2	15	.....	.....	6	72	461	101, 102, 105
Economic Geology	Geology 4.....	2	15	4	2	.....	54	407	405, 406,
Contracts and Specifications	Contracts.....	1	15	2	1	.....	74	496	.....
Thesis	Mining Eng. 9	3	.....	.....	.....	3	73	465	400, 420

MORNING TIME TABLE.

THIRD AND FOURTH YEARS. CIVIL ENGINEERING. FIRST SEMESTER.

HOUR	9—10	10—11	11—12	12—1
Monday	Mechanics of Engineering.	R. R. Location, 1st 6 weeks. R. R. Constr. & Main., 9 weeks.	Masonry Construction.	Roofs and Bridges, 6 weeks. Water Supply, 9 weeks.
Tuesday	Mechanics of Engineering.	R. R. Location, 1st 6 weeks. R. R. Constr. & Main., 9 weeks.	Masonry Construction.	Roofs and Bridges, 6 weeks. Water Supply, 9 weeks.
Wednesday	Mechanics of Engineering.	R. R. Location, 1st. 6 weeks. R. R. Constr. & Main., 9 weeks	Masonry Construction.	Roofs and Bridges, 6 weeks. Water Supply, 9 weeks.
Thursday	Mechanics of Engineering.	R. R. Location, 1st 6 weeks. R. R. Constr. & Main., 9 weeks.	Masonry Construction.	Roofs and Bridges, 6 weeks. Water Supply, 9 weeks.
Friday	Mechanics of Engineering.	R. R. Location, 1st 6 weeks. R. R. Constr. & Main., 9 weeks.	Masonry Construction.	Roofs and Bridges, 6 weeks. Water Supply, 9 weeks.
Saturday				

THIRD AND FOURTH YEARS. SECOND SEMESTER.

HOUR	9—10	10—11	11—12	12—1
Monday	Mechanics of Eng., 9 weeks. Graphic Statics, 6 weeks.	Theoretical Hydraulics, 9 weeks Roads and Pavements, 6 weeks.	Hydraulic Engineering, 9 weeks Tunneling 3 weeks. Contracts. 3 weeks.	Sewerage, 9 weeks. Sewage Disposal, etc. 6 weeks.
Tuesday	Mechanics of Eng., 9 weeks. Graphic Statics, 6 weeks.	Theoretical Hydraulics, 9 weeks Roads and Pavements, 6 weeks.	Hydraulic Engineering, 9 weeks Tunneling, 3 weeks. Contracts. 3 weeks.	Sewerage, 9 weeks. Sewage Disposal, etc., 6 weeks.
Wednesday	Mechanics of Eng., 9 weeks. Graphic Statics, 6 weeks.	Theoretical Hydraulics, 9 weeks Roads and Pavements, 6 weeks.	Hydraulic Engineering, 9 weeks Tunneling, 3 weeks. Contracts, 3 weeks.	Sewerage, 9 weeks. Sewage Disposal, etc., 6 weeks.
Thursday	Mechanics of Eng., 9 weeks. Graphic Statics, 6 weeks.	Theoretical Hydraulics, 9 weeks Roads and Pavements, 6 weeks	Hydraulic Engineering, 9 weeks Tunneling, 3 weeks. Contracts, 3 weeks.	Sewerage, 9 weeks. Sewage Disposal, etc., 6 weeks.
Friday	Mechanics of Eng., 9 weeks. Graphic Statics, 6 weeks.	Theoretical Hydraulics, 9 weeks Roads and Pavements, 6 weeks.	Hydraulic Engineering, 9 weeks Tunneling, 3 weeks. Contracts. 3 weeks.	Sewerage, 9 weeks. Sewage Disposal, etc , 6 weeks.
Saturday	Roofs and Bridges 15 weeks.	Roofs and Bridges 15 weeks.	Roofs and Bridges 15 weeks.	Roofs and Bridges 15 weeks.

MORNING TIME TABLE.

THIRD & FOURTH YEARS. MECHANICAL AND ELECTRICAL ENGINEERING. FIRST SEMESTER.

HOUR	9—10	10—11	11—12	12—1
Monday	Steam Power Plants. Mechanics of Engineering.	Alternating Currents. Electrical Eng. and Min. Eng. Machine Design.	Heating and Ventilating. Electrical Machinery.	Storage Battery. Thermodynamics.
Tuesday	Steam Power Plants. Mechanics of Engineering.	Alternating Currents.	Heating and Ventilating. Electrical Abstracts.	Storage Battery. Thermodynamics.
Wed.	Steam Power Plants. Mechanics of Engineering.	Alternating Currents. Electrical Eng. and Min. Eng. Machine Design.	Heating and Ventilating. Electrical Machinery.	Storage Battery. Thermodynamics.
Thurs.	Steam Power Plants. Mechanics of Engineering.	Alternating Currents.	Heating and Ventilating. Electrical Machinery.	Storage Battery. Thermodynamics.
Friday.	Steam Power Plants. Mechanics of Engineering.	Alternating Currents. Electrical Eng. and Min. Eng Machine Design.	Heating and Ventilating. Kinematics of Machines.	Storage Battery. Thermodynamics.
Saturday				

THIRD & FOURTH YEARS. SECOND SEMESTER.

HOUR	9—10	10—11	11—12	12—1
Monday	Steam Power Plants. Mechanics of Engineering.	Alternating Currents. Theoretical Hydraulics.	Photometry.	Elec. Distribution.
Tuesday	Steam Power Plants. Mechanics of Engineering.	Alternating Currents. Theoretical Hydraulics. Machine Design Lecture	Photometry. Electrical Machinery.	Elec. Distribution. Thermodynamics.
Wed.	Steam Power Plants. Mechanics of Engineering.	Alternating Currents. Theoretical Hydraulics.	Photometry. Electrical Machinery.	Elec. Distribution. Electrical Abstracts.
Thurs.	Steam Power Plants. Mechanics of Engineering.	Alternating Currents. Theoretical Hydraulics. Machine Design Lecture.	Photometry. Machine Design.	Elec. Distribution. Machine Design.
Friday	Steam Power Plants. Mechanics of Engineering.	Alternating Currents. Theoretical Hydraulics.	Photometry. Electrilal Machinery.	Elec. Distribution. Thermodynamics.
Saturday				

TIME TABLE.

THIRD AND FOURTH YEARS. MINING ENGINEERING. FIRST SEMESTER.

DAYS OF WEEKS	9—10	10—11	11—12	12—1
Mon.	Theoretical Mechanics, 15 weeks. Mill Construction, 6 weeks. Electrical Engineering, 9 weeks.	Metallurgy of Iron and Steel 9 weeks Principles of Metallurgy.		Theromdynamics. Ore Dressing.
Tues.	Theoretical Mechanics, 15 weeks. Mill Construction, 6 weeks.	Economic Geology.	Applied Geology. Economic Geology.	Thormodynamics.
Wed.	Theoretical Mechanics, 15 weeks. Electrical Engineering, 9 weeks. Mill Construction, 6 weeks.	Metallurgy of Iron and Steel 9 weeks. Principles of Metallurgy.		Thermodynamics. Ore Dressing.
Thurs.	Theoretical Mechanics, 15 weeks. Metallurgical Laboratory.	Metallurgical Laboratory.	Metallurgical Laboratory. Applied Geology.	Thermodynamics. Metallurgical Lab.
Fri.	Theoretical Mechanics, 15 weeks. Electrical Engineering, 9 weeks. Mill Construction, 6 weeks.	Metallurgy of Iron and Steel 9 weeks. Principles of Metallurgy.	Military Science.	Thermodynamics. Ore Dressing.
Sat.	Mill Construction. Geological Excursion.	Economic Geology.		

TIME TABLE.

THIRD AND FOURTH YEARS. MINING ENGINEERING. SECOND SEMESTER.

	9—10	10—11	11—12	12—1
Monday	Mechanics of Materials, 9 weeks Graphic Statics, 6 weeks Exploitation	Theoretical Hydraulics, 9 weeks. Exploration and Excavation.	Contracts and Specifications, 9 weeks. Ventilation and Valuation, 12 weeks. Mineralogy.	Non-Ferrous Metallurgy.
Tuesday	Mechanics of Materials 9 weeks Graphic Statics, 6 weeks Non-ferrous Metallurgy	Theoretical Hydraulics, 9 weeks. Exploration and Excavation,	Contracts and Specifications, 3 weeks. Ventilation and Valuation. 12 weeks. Mineralogy.	Steam Machinery. Exploitation.
Wednesday	Mechanics of Materials 9 weeks Graphic Statics, 6 weeks Economic Geology.	Theoretical Hydranlics, 9 weeks. Explorotion and Excavation.	Contracts and Specifications, 3 weeks. Ventilation and Valuation. 12 weeks. Mineralogy.	Non- Ferrus Metallurgy.
Thursday	Mechanics of Materials, 9 weeks Graphic Statics, 6 weeks Economic Geology.	Metallurgical Laboratory Exploration and Excavement.	Contracts and Specifications. 3 weeks. Metallurgical Laporatory. Mineralogy.	Metallurgical Laboratory.
Friday	Mechanics of Materials, 9 weeks Graphic Statics, 6 weeks Economic Geology.	Theoretical Hydraulics. 9 weeks. Exploration and Excavation. Military Science,	Contracts and Specifications. 3 weeks. Ventilation and Valuation, 12 weeks. Mineralogy.	Steam Machinery. Exploitation.
Saturday	Thesis. Quanitative Analysis.	Theoretical Hydraulics, 9 weeks. Quanitative Analysis	Thesis. Quanitative Analysis.	Thesis. Quanitative Analysis.

AFTERNOON TIME TABLE

THIRD AND FOURTH YEAR. CIVIL, ELECTRICAL, MECHANICAL AND MINING ENGINEERS FIRST SEMESTER

	2—3	3—4	4—5	5—5.30	5.30—6
Monday	Quant. Anal. Surveying and Drafting.....15 wks. Materials Testing..15 " Machine Design....15 "	Quan. Anal. Surveying and Drafting ....15 wks. Drafting .....15 " Materials Testing..15 " Machine Design...15 "	Quan. Anal. Surveying & Drafting.....15 wks. Materials Testing..15 " Machine Design...15 "		
Tuesday	Surveying and Drafting.....15 " R. R. Structures... 7½ " Water Supply Design 7½ " Electric Lab. Mine Surveying.....15 "	Surveying and Drafting.....15 " R. R. Structures....7½ " Water Supply Design 7½ " Electric Lab. Mine Surveying.....15 "	Surveying and Drafting.....15 " R. R. Structures.... 7½ " Water Supply Design 7½ " Mine Surveying....15 "		
Wed.	Surveying and Drafting.....15 " R, R. Structures... 7½ " Water Supply Design 7½ " Machine Design...15 " Quant. Anal. Mine Plant Design.15 "	Surveying and Drafting.....15 " R. R. Structures.... 7½ " Water Supply and Design..... ..... 7½ " Machine Design...15 " Quant. Anal. Mine Plant Design.15 "	Surveying and Drafting.....15 " R. R. Structures...15 " Water Supply and Design.....7½ " Machine Design...15 " Quan. Anal. Mine Plant Design.15 "	Military and Physical Drill....15 "	
Thurs.	Roofs and Bridges.15 " Machine Lab.....15 " Metall. Lab .....15 "	Roofs and Bridges.15 " Mech. Lab.....15 " Metall. Lab.....15 "	Roofs and Bridges.15 " Mech. Lab.....15 " Metall. Lab.....15 "		
Friday	Surveying & Draft.15 " Roofs and Bridges.15 " Quant. Anal..... Mine Plant Design 15 "	Surveying & Draft.15 " Roofs and Bridges.15 " Quant. Anal. Mine Plant Design.15 "	Surveying & Draft.15 " Roofs and Bridges.15 " Quant. Anal. Mine Plant Design.15 "	Military and Physical Drill....15 "	
Saturday					

AFTERNOON TIME TABLE.

CIVIL, ELECTRICAL, MECHANICAL AND MINING ENGINEERING.

THIRD AND FOURTH YEARS. SECOND SEMESTER.

	2–3	3–4	4–5	5–5.30	5.30–6
Monday	Materials Testing.....15 wks. Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 " Quantitative Anal.....15 " Mining Thesis.....15 "	Materials Testing.....15 wks. Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 " Quan. Analysis.....15 " Mining Thesis.....15 "	Material Testing.....15 wks. Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 " Quant. Anal .....15 " Mining Thesis.....15 "		
Tuesday	Hydraulic Testing.....15 wks. Assaying.....15 " Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design ..... 2 "	Hydraulic Testing.....15 wks. Assaying.....15 " Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 "	Hydraulic Testing.....15 wks. Assaying.....15 " Masonry Design..... 1 " Bridge Design..... 9 " Sewer Design..... 2 "		
Wed.	Quanitative Anal.....15 wks. Mine Plant Design.....15 " Masonry Design..... 4 " Bridge Design..... ... 9 " Sewer Design..... 2 "	Quant. Analysis.....15 wks. Mine Plant Design.....15 " Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 "	Quant. Analysis.....15 wks. Mine Plant Design.....15 " Masonry D-sign..... 4 " Bridge Design..... .. 9 " Sewer Design..... 2 "	Military and Physical Drill 15 wks.	
Thurs.	Assaying.....15 wks. Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 " Metallurgical Lab.....15 " Mechanical Lab.....15 "	Assaying.....15 wks. Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 " Metall. Lab.....15 " Mech. Lab.....15 "	Assaying .....15 wks. Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 " Metall Lab.....15 " Mech. Lab.....15 "		
Friday	Mine Plant Design..... Mining Thesis..... Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 "	Mine Plant Design.... Mining Thesis..... Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 "	Mine Plant Design.... Mining Thesis..... Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 "	Military and Physical Drill 15 wks.	

GRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE.

1910.

Name.	Home Address.	Where Previously Educated.
F. R. Archibald,.....	Halifax, N. S.....	Dalhousie University.
F. M. Dawson,.....	Truro, N S.....	Dalhousie University.
C. L. Dimock,.....	Upper Newport, N. S...	Dalhousie University.
T. W. Hardy, Jr.,.....	Halifax, N. S.....	Dalhousie University.
E. S. Kent,.....	Truro, N. S.....	Dalhousie University.
A. G. McAulay,.....	Glace Bay, N. S.....	Dalhousie University.
N. W. McKay,.....	Balmoral Mills.....	Dalhonsie University.
Walter Putman,.....	Maitland, N. S.....	Dalhousie University.
E. L. Thorne, Jr.,.....	Dartmouth, N. S.....	Dalhousie University.

UNDERGRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE.

1910.

Name.	Home Address.	Where Previously Educated.
H. F. Bober,.....	Halifax; N. S.....	King's College.
J. L. Cavanagh,.....	New Glasgow,*N. S....	Dalhousie University.
*E. W. G. Chapman, ..	Halifax, N. S.....	Dalhousie University.
K. G. Chisholm,.....	Halifax. N. S.....	Dalhousie University.
D. M. Collingwood,...	Up. Parkstone, Eng....	Dalhousie University.
*C. S Creighton,.....	Dartmouth, N. S.....	Dalhousie University.
T. M. DeBlois,.....	Halifax, N. S.....	Dalhousie University.
C. K. Hood,.....	Yarmouth, N. S.....	Mt. Allison University.
J. F. Lumsden,.....	Baddeck, C. B.....	Mt. Allison University.
R. W. McColough,....	Waverley, N. S.....	Dalhousie University.
J. A. McKay,.....	Balmoral Mills, N. S...	Dalhousie University.
*C. E. McKenzie,.....	Springhill, N. S.....	Dalhousie University.
L. A. Mylius,.....	Halifax, N. S.....	Dalhousie University.
G. S. Stairs,.....	Halifax, N. S.....	Dalhousie University.
G. H. Thurber, ...	Harcourt, N. B...	King's College.

* Special student.